CONTRACT PERIOD THROUGH NOVEMBER 30, 2003

TO: All Departments

FROM: Department of Materials Management

SUBJECT: Contract for **TRAFFIC SIGNAL SYSTEM FIELD INFRASTRUCTURE**

Attached to this letter is published an effective purchasing contract for products and/or services to be supplied to Maricopa County activities as awarded by Maricopa County on **November 19, 2001.**

All purchases of products and/or services listed on the attached pages of this letter are to be obtained from the vendor holding the contract. Individuals are responsible to the vendor for purchases made outside of contracts. The contract period is indicated above.

Wes Baysinger, Director
Materials Management

WP/mm
Attach

Copy to: Clerk of the Board
Yogesh Mantri, MCDOT
Jim Baker, MCDOT
Monica Mendoza, Materials Management

I. MULTIPLE STEP SOLICITATION PROCESS:

This solicitation will be of a multi step process as called for in the Maricopa County Procurement Code MCI-326, 327, and 328. The steps will be the following:

1 Phase One - Call for technical proposals.

2 Phase Two - Request for sealed bid for pricing, for the proposals that are acceptable to Maricopa County, by the proposal evaluation committee.

This request for un-priced technical proposals SERIAL **01084-MS** for **TRAFFIC SIGNAL SYSTEM FIELD INFRASTRUCTURE** is issued on July 19, 2001. The proposals are to be date stamped in at the Materials Management Office at 320 W Lincoln St, Phoenix AZ 85003 by 2:00 p.m. on August 14, 2001. Proposals will be opened as called for by the Maricopa County Procurement Code. The proposals will be evaluated by an evaluation committee and the successful vendors notified to return pricing for their proposals as called for, to be opened in a public opening.

II. SOURCE SELECTION (MULTI-STEP):

1 Phase One - Technical Proposals:

1.1 A mandatory pre-technical proposal conference will be conducted to explain the procurement requirements, potential PROPOSERS are required to attend. It will be held on , July 31, 2001 at 9:00 A.M., at the Materials Management Center, 320 West Lincoln, Phoenix AZ 85003.

1.2 Proposers shall submit un-priced technical proposal for the Scope of Work. Only unpriced offers are requested at this time. (9 Copies) Pricing pages furnished in RFP are for informational purposes only.

1.3 Technical proposals are due on , August 14 2001, 2:00 p.m., at the Materials Management Center, 320 West Lincoln, Phoenix AZ 85003.

1.4 Technical proposal requests may be amended after the unpriced submission. The amendments will be distributed only to PROPOSERS who have submitted unpriced technical offers. If the amendment materially changes the procurement, the invitation to submit technical offers will be canceled or reissued.

1.5 In this phase, technical proposal will be evaluated solely in accordance with the established criteria set forth in the proposal, and will be determined to be acceptable for Phase two (pricing) or unacceptable. Discussions may be conducted with PROPOSERS of acceptable or potentially acceptable offerors. ONLY PROPOSALS RECEIVING 75 POINTS OR MORE WILL BE ACCEPTABLE FOR PHASE 2; THOSE RECEIVING LESS THAN 75 POINTS WILL BE DEEMED UNACCEPTABLE.

2 Phase Two - Competitive Sealed Bidding:

2.1 Only PROPOSERS with acceptable evaluations will be invited to submit a competitive sealed bid.

2.2 Requested PROPOSERS shall submit a sealed price bid for each of the line items identified in the price sheet deemed acceptable in evaluation.

2.3 A pre-bid conference will be conducted to explain the bid requirements. An addendum to the Invitation to Bid will be issued, if necessary, to make changes to the Invitation to Bid, correct defects or ambiguities, furnish to bidders information, correct quantities, or bidding schedule. The

addendum will be sent to all PROPOSERS deemed acceptable in Phase One - and will require that the bidder acknowledge receipt of the addendum.

2.4 Bidders may modify or withdraw their bids at any time before bid opening. The County will receive bids for this Solicitation until October 4, 2001 2:00 p.m. at the Materials Management Center, 320 West Lincoln, Phoenix, Arizona 85003.

2.5 Bids and bid addenda will be opened publicly. The name of each bidder, and other information deemed appropriate will be read out loud. A late bid, withdrawal and/or modification will be rejected. All bids shall be valid for a period of _120__ days from bid opening date.

2.6 All blank spaces on the Bid Form shall be fully filled in, using ink or a typewriter. The signature shall be in longhand, written in ink, and executed by a principal duly authorized to make contracts. The Bidder's legal name shall be fully stated. The completed Bid Form shall be without iteration, alteration or erasure.

2.7 Bids shall not contain any recapitulation of the work to be done, and alternate bids will not be considered unless called for in the Bidding Documents. Oral, telegraphic or telephonic bids will not be considered.

2.8 Bids shall be enclosed in a sealed, opaque envelope plainly marked on the outside with the name of the bid title, and the bidder's name. Envelope shall be enclosed in a mailing envelope.

2.9 A contract will be awarded to the lowest bidder. Negotiations with bidders are not permitted.

2.10 After bid award, all proposals shall be available for public inspection.

3 Summary of solicitation period:

3.1 Advertisement To PROPOSE – July 19, 2001 and July 26, 2001

3.2 Phase One - Technical Proposal

3.2.1 Pre-technical proposal Conference – July 31, 2001

3.2.2 Technical proposal due - on or before August 14, 2001

3.2.3 Evaluation Period – August 14 – September 14, 2001

3.2.4 Notification of selection - September 21, 2001

3.3 Phase Two - Competitive Sealed Bids (FROM PROPOSERS RECEIVING 75 POINTS OR MORE FROM PHASE 1 ONLY).

3.3.1 Pre-bid conference - Optional

3.3.2 Competitive Sealed Bids due – October 4, 2001, 2:00 p.m.

3.3.3 Bid opening – October 4, 2001, 2:00 p.m.

3.3.4 Evaluation period – October 5 – October 12, 2001

3.4 Proposed Contract Award

3.4.1 Contract and award – (TO BE DETERMINED) , 2001

The successful Proposer must be prepared with all resources needed to start work on (TO BE DETERMINED), 2001.

1.0 INTENT

1.1 DESCRIPTION OF WORK

1.1.1 Maricopa County is soliciting bids from qualified providers of traffic signal equipment for the purpose of creating a traffic signal system operated and maintained by the Maricopa County Department of Transportation (MCDOT). All acceptable proposers shall allow all public entities within Maricopa County (ie. municipalities, cities, state agencies, etc.) to purchase using this contract under the same pricing, terms and conditions.

1.1.2 This contract will be used by MCDOT to procure field infrastructure elements for various projects throughout the County. Unless otherwise identified herein, the field infrastructure elements furnished under this contract will be installed by MCDOT or by installers hired by MCDOT under separate contracts.

The successful Bidder will supply the following field infrastructure elements on an "as needed" basis for a 5-year period beginning on or about (TO BE DETERMINED), 2001.

1. ITEM NO.	2. ESTIMATED QUANTITY	DESCRIPTION
1.	10/year	Fiber Optic Transceiver (Standalone)
2.	5/year	Fiber Optic Transceiver (Card)
3.	1	Optical Transceiver Card Cage
4.	10/year	Twisted-Wire Pair Modem
5.	20/year	Telephone Modem
6.	20/year	EIA-232 Line Sharing Unit
7.	20/year	Spread Spectrum Radio Equipment
8.	25/year	TS-2 Type 2 Controller
9.	25/year	TS-2 Type 1 Controller Field Cabinet, including auxiliary equipment and cabling
10.	5/year	Cabinet Extension
11.	2	Software
12.	1	Notebook Computer
13.	2	Traffic Signal Simulation Test Box
14.	1	Work Bench

The successful Bidder will furnish all interface cables and accessories necessary for interconnecting the supplied components and connecting them to the fiber optic infrastructure, twisted wire pair infrastructure, and the telephone company network.

MCDOT reserves the right to place an order for any or all items in any combination, at any time throughout the contract period.

The successful Bidder will provide the following services (scope and fee proposals including hourly rates and cost per mile will be requested in Phase 2 of the selection process):

1.1.2.1 The successful Bidder will test the feasibility of utilizing spread spectrum radio communications at approximately 20 locations per year. The successful Bidder will be required to work closely with MCDOT to demonstrate the successful compatibility of the equipment during the testing phase;

1.1.2.2 The successful Bidder will also be responsible for providing on- and off-site training; and,

1.1.2.3 The successful Bidder will provide non-warranty maintenance and repair on an as-needed basis

1.1.3 Initially, unpriced proposals are solicited from potential Suppliers. Pricing will be requested from successful Proposers after Phase 1 – Technical Proposals. All responses to the request for bids should include line item pricing for each of the above-mentioned field elements as outlined on the accompanying price sheet. The successful Bidder shall provide a price list of all individual parts, auxiliary equipment, and cables that are essential for operation of the TS 2 Controller and Cabinet. These parts include, but are not necessarily limited to, those specified in the Scope of Work (for example, malfunction management units, load switches, power supply boxes, detector cards, etc.).

1.2 BACKGROUND

1.2.1 Maricopa County elected to create a traffic signal system and began planning the system in 1999. The general goal of the system is to facilitate second-by-second monitoring and control of traffic signals that are owned/operated by MCDOT. The system goals and objectives, functional requirements, and a communications plan were produced in 2000. In 2001, efforts are underway to procure the central signal system software, the central hardware and central communications, and the field infrastructure.

1.2.2 In 2001, Maricopa County completed a regional cooperative effort to develop functional requirements for central signal system software that would meet the needs of many agencies. As a result, Maricopa County will be procuring central signal system software from a software supplier under separate contracts.

1.2.3 Maricopa County will be procuring central hardware and central communications servers under separate contracts. The central equipment may be thought of as the equipment inside the traffic management center (TMC) that is necessary to process signals sent to and from the field. This request for bids covers the field infrastructure components, including communications equipment that is used to transmit information between field elements and between the field and central elements. Preliminary plans for communications between field infrastructure and the TOC are documented in the MCDOT TMS Telecommunications System and Alternatives document. Five approaches are outlined in the document. All of the approaches for traffic signal controllers utilize the same daisy chain (point to multi-point) communication topology, but vary in the use of the deployed communication equipment. The descriptions below are provided as background information for the proposing Supplier(s).

Communication Approach #1 utilizes existing infrastructure to link the signal controller cabinets. In some cases, however, the existing infrastructure is not complete and additional equipment (new modems, for example) would be necessary. Leased lines will be used to connect groups of signals to the TOC. Thirteen locations have been identified as candidates for this approach.

At other locations where there is no existing infrastructure and wireless communications are not feasible, Communication Approach #2, which includes interconnecting signals in a corridor with new fiber optic cable, might be used. Leased lines would be used to connect the fiber optic cable corridors with the TOC. Twenty-three locations have been identified as candidate locations for Approach #2.

The majority of the locations are candidates for Communication Approach #3. This approach involves providing spread spectrum communications at the local corridor level, and transmitting data between the TMC and the local corridors over leased lines. Approximately 50 locations are candidates for spread spectrum communications.

Communications Approach #4 includes direct links between individual signal controller and the TOC via leased lines. Several signal cabinet locations are isolated from other MCDOT cabinets. These locations warrant a direct communication link via leased lines that are not shared with any other controllers.

Communications Approach #5 involves fiber optic communication via the regional WAN to gain access to the neighboring agencies' infrastructure.

1.3 GLOSSARY

ASC	Actuated Signal Controller
BER	Bit Error Ratio
BIU	Bus Interface Unit
COTS	Commercial Off the Shelf
CTS	Clear To Send
FCC	Federal Communications Commission
GFI	Ground Fault Interrupter
IEEE	Institute of Electrical And Electronic Engineers
ITS	Intelligent Transportation Systems
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MMU	Malfunction Management Unit
MOE	Measure of Effectiveness
MTBF	Mean Time Between Failure
MUTCD	Manual on Uniform Traffic Control Devices
NEMA	National Electrical Manufacturing Association
NTCIP	National Transportation Communications for ITS Protocol
OTR	Optical Transceiver
RTS	Request To Send
SMFO	Single Mode Fiber Optic
STMP	Simple Transportation Management Protocol
TBC	Time Based Control
TMC	Traffic Management Center
TMS	Traffic Management System
TOC	Traffic Operations Center
TOD	Time of Day
TWP	Twisted Wire Pair
U.L.	Underwriter Laboratories

2.0 SCOPE OF WORK

2.1 FIBER OPTIC TRANSCEIVERS

2.1.1 The Supplier shall furnish an Optical Transceiver (OTR) to communicate over a pair of single-mode fibers. The OTR shall provide a high reliability, bi-directional RS-232 serial data, multidropped ("daisy-chained") communication link between field devices and to the central equipment, via a direct fiber connection to central or leased telephone line between central and the first OTR on the daisy-chain.

2.1.2 The OTR shall be a drop and repeat transceiver. The OTR shall provide an electrical signal interface for an RS-232 port. The OTR shall provide an electrical signal interface to 4 SMFO interfaces (2 transmit and 2 receive) that support add/drop/repeat capability allowing field controllers to be interconnected in a multidropped configuration.

2.1.3 The OTR shall support data rates from 1,200 bps to 56 kbps. All units shall be identical and shall be interchangeable. The OTR shall require no user adjustments other than dipswitch selections for the electrical signal interface. The OTR shall be capable of receiving electrical RS-232 transmission signals from the attached controller and converting the electrical signals to optically modulated signals.

2.1.4 The RS-232 format of the OTR shall be compatible with the TS-2 signal controller and telephone modem being provided. The RS-232 interface on the OTR shall be from a DB-25 or DB-9 connector. The use of a terminal block on the OTR or between the OTR and the controller will not be allowed. Each OTR shall be provided with a 4-foot interconnect cable. The interconnect cable shall have a connector on one end that directly mates to the RS-232 port of the OTR and the connector on the other end shall mate directly to the RS-232 port on the TS-2 signal controller. Documentation on the assigned pin-out configuration for each end of the interconnect cable shall be provided. In the event that a loop through between the RTS and CTS pins are necessary and this function is accommodated within the interconnect cable configuration, it shall be clearly identified in the interconnect cable documentation.

2. 1.5 The optical interface to the OTR shall be single mode fiber via ST connectors. Female connectors shall be provided on the OTR device as follows:

2.1.5.1 Transmit up-link;
2.1.5.2 Transmit down-link;
2.1.5.3 Receive from up-link; and
2.1.5.4 Receive from down-link.

2. 1.6 When a transmitter and receiver are interconnected via a single mode fiber, a minimum optical loss budget of 0 to 23 dB shall be accommodated while providing a BER not exceeding one error in 10^9 bits. The data rate of the OTR link shall be automatically adaptable to the RS-232 data rate of the attached controller electrical interfaces. The optical repeating process shall not add signal distortion or optical noise that would compromise the link performance. The optical transmitters used shall be solid state laser diodes and shall maintain performance over the complete operating temperature range.

2. 1.7 The OTRs shall include an anti-streaming capability selectable via dip switch as:

2.1.7.1 On/Off (no time out); and
2.1.7.2 Binary selection from 4 to 32 seconds.

The OTR shall be designed to operate to specifications in a -22°F to +165°F environment and relative humidity of 5% to 95%, non-condensing. No cooling airflow shall be required. The OTR shall be sealed to prevent damage from dust or corrosive chemicals.

2.1.8 The OTR shall include at least the following visual signal indicators:

2.1.8.1 Transmit Data 1 (TD-1);
2.1.8.2 Receive Data 1 (RD-1);
2.1.8.3 Transmit Data 2 (TD-2);
2.1.8.4 Receive Data 2 (RD-2);
2.1.8.5 Power (PWR); and
2.1.8.6 OTR/FT Fault.

2.1.9 The OTR power input circuitry shall be designed to protect the OTR electronics from damage due to power surges or over/under voltage conditions. The OTR shall automatically recover from an over/under voltage condition when the prime power is

restored. The guidelines of IEEE Standard 1100-1992 for grounding sensitive electronic equipment shall apply to the OTR power interconnect.

2.1.10 There shall be no internal connection between signal ground and chassis ground. Provisions to prevent damage to OTR electronics from lightning via any metallic cable interconnect with the OTR shall be included in the design.

2.1.11 The OTRs supplied shall be U.L. (Underwriters Laboratories) listed and have a MTBF rating of at least 100,000 hours.

2.1.12 The OTR shall comply with FCC (Federal Communications Commission) Class A requirements and Bellcore TR-NWT-001089 electromagnetic compatibility requirements.

2.1.13 The OTR shall be available in both standalone mount and a card cage mount. The standalone mount will be used in all field cabinet applications for interfacing a TS-2 controller and/or a telephone modem.

2.1.13.1 The standalone OTR devices shall be provided with an aluminum housing that is treated to prevent corrosion and does not exceed 5" W x 7" L x 1" H. External markings shall include the product name, model number, part number, serial number, manufacturer's name, connection labels, and indicator labels.

A voltage converter shall be provided with each standalone OTR device. The OTR power converter shall operate from a prime power with the following characteristics:

Input Voltage:	115	VAC	±15%
Frequency:	60	Hz	±10%
Phase: Single			
Maximum Load:	200 mA		

2.1.13.2 The OTR card shall be capable of being installed in a card cage. The OTRs shall be securable once installed in a drawer. The front panel shall include functional identification markings. The OTRs shall support fault tolerant power supplies (converters) when mounted in a common electronic chassis, including a margin for surge currents upon power up. A failure of one OTR module shall not impact the operation of other OTR modules installed within a common electronic chassis.

2.1.13.3 The OTR card cage shall be 19" rack mountable, not to exceed 3U (5-1/4") in height, and provide common power supplies within the OTR electronic drawer (chassis) that operate from 115 VAC ±15%, 60 Hz ±10%, single-phase power, with a maximum load of 200mA. The chassis shall include a power status indicator and a circuit breaker for power control. The power distribution design shall support "hot swap out" of a failed OTR module without adversely impacting communications or other OTR modules. The power interconnects for the chassis shall be via a power cord with a female power connector at the chassis interface and male plug (3 prong UL type) at the AC power interface.

2.2 TWISTED-WIRE PAIR MODEMS

2.2.1 The Supplier shall furnish modems to communicate over a copper twisted wire pair (TWP) communication medium. The twisted-wire pair modems shall provide a high reliability, bi-directional RS-232 serial data, multipoint ("daisy-chained") communication link between field devices. The TWP modem shall also operate as a leased line interface modem for tying into the TELCO network.

2.2.2 The Supplier shall provide modems that communicate at 9,600 bps over both private and leased line applications. The modems shall selectable for operation on 2-wire, half-duplex and 4-wire full-duplex communications circuits.

2.2.3 The modem shall include at least the following LED indicators:

2.2.3.1 Power (PWR);
2.2.3.2 Transmit Data (TXD);
2.2.3.3 Receive Data (RXD);
2.2.3.4 Request To Send (RTS); and
2.2.3.5 Clear To Send (CTS).

2.2.4 The modem shall support anti-streaming by turning the transmitter off, after a selectable period of time, in the event that the controller malfunctions and streams a constant signal to the modem.

2.2.5 The modems shall also be fully functional over an ambient outdoor temperature range of –40ºF to +165ºF and an outdoor ambient humidity of 5% to 95% non-condensing.

2.2.6 The modems shall be standalone units with an aluminum housing that is treated to prevent corrosion. External markings shall include the product name, model number, part number, serial number, manufacturer's name, connection labels, and indicator labels.

2.2.7 A voltage converter shall be provided with each standalone modem. The power converter shall operate from a prime power with the following characteristics:

Input Voltage:	115	VAC	±15%
Frequency:	60	Hz	±10%
Phase:	Single		
Maximum Load:	200 mA		

2.2.8 The use of a terminal block between the modem and the controller will not be allowed. Each modem shall be provided with a 4-foot interconnect cable. The interconnect cable shall have a connector on one end that directly mates to the RS-232 port of the modem and the connector on the other end shall mate directly to the RS-232 port on the TS-2 signal controller. Documentation on the assigned pin-out configuration for each end of the interconnect cable shall be provided. In the event that a loop through between the RTS and CTS pins are necessary and this function is accommodated within the interconnect cable configuration, it shall be clearly identified in the interconnect cable documentation.

2.3 TELEPHONE MODEMS

2.3.1 Telephone modems shall provide for point-to-point communications, via a dial-up telephone line, between the central equipment at the TMC and the field cabinet location.

2.3.2 The Supplier shall provide commercial off the shelf (COTS) external modems that meet the V.34 standard.

2.3.3 The modems shall also be fully functional over an ambient outdoor temperature range of -40°F to +165°F and an outdoor ambient humidity of 5% to 95% non-condensing.

The modem shall include at least the following LED indicators:

2.3.3.1 Power (PWR);

2.3.3.2 Transmit Data (TXD); and

2.3.3.3 Receive Data (RXD).

2.3.4 The modems shall be standalone units with an aluminum housing that is treated to prevent corrosion. External markings shall include the product name, model number, part number, serial number, manufacturer's name, connection labels, and indicator labels.

2.3.5 An interconnect cable, 4-foot minimum, shall be provided with the modem for interconnecting to the local controller directly or for interconnecting to the line sharing unit directly.

2.4 EIA-232 LINE SHARING UNIT

2.4.1 The EIA-232 line sharing unit shall receive the EIA-232 channel from the telephone modem and provide an EIA-232 port for interfacing the local controller and an EIA-232 port for interfacing the multi-point communication transceiver (OTR, TWP modem or spread spectrum equipment). All communication ports on the line-sharing unit shall share the same EIA-232 communication channel.

2.4.2 Two interconnect cables, 4-foot minimum, shall be provided with the line-sharing unit. One for interconnecting to the local controller directly and the other for interconnecting directly to the communication transceiver (OTR, TWP modem or spread spectrum equipment).

2.5 SPREAD SPECTRUM RADIO EQUIPMENT

2.5.1 The Supplier shall furnish spread spectrum radio equipment to communicate over a wireless communication medium. The spread spectrum radio equipment shall provide a high reliability, bi-directional RS-232 serial data, multi-point communication link between field devices. All drops for the multi-point wireless circuit shall share the same EIA-232 communication channel. At the first field cabinet on the multi-point circuit, the spread spectrum radio equipment shall interface with the central equipment, via an extension of the shared EIA-232 channel over a leased telephone line.

2.5.2 The spread spectrum radio shall provide, at a minimum, selectable baud rates between 1200 and 19,200 bps, inclusive. Point-to-point and point-to-multipoint bi-directional configurations shall be supported.

2.5.3 All system components will be required to provide for a fully functional operation. The unit price for the spread spectrum item shall include all communication equipment and accessories necessary to support a single spread spectrum radio site that provides transmitting, receiving, and repeating (for extending range beyond line of sight to the first cabinet on the drop.) capabilities for both point-to-point and point-to-multipoint bi-directional configurations. It is anticipated that 30 percent of the units purchased will need to function as repeater sites.

2.5.4 Transceiver:

The spread spectrum radio (SSR) shall be off-the-shelf equipment that operates within the 902-928 MHz range, capable of 1200 bps to 115.2 Kbps asynchronous, half-duplex operation. The unit shall also support an interface to a full-duplex EIA-232 channel. The unit shall be FCC certified.

2.5.4.1 Transmitter Range: up to 20 miles
2.5.4.2 Receiver Sensitivity: -106 dB
2.5.4.3 Maximum Output Power: 1 Watt
2.5.4.4 Channels/Hop Pattern: 8 (minimum)
2.5.4.5 Processing Gain/System Gain: 15 dB/135dB
2.5.4.6 Temperature Range: –40°F to +165°F
2.5.4.7 Humidity: 5% to 90%, non-condensing

2.5.5 Antenna:

The antenna shall be a directional Yagi and provide a nominal gain of at least 8.5 dB. The antenna shall be approximately 24" (height) by 6.4" (width). Operate within a temperature range of -40ºF to +165ºF and be non-condensing up to 95% humidity. All mounting hardware and accessories necessary to install the antenna shall be included at no additional cost.

2.5.6 Cables:

The furnished cabling with preinstalled connections for interconnecting the antenna with the transceiver. The cable shall be a low loss Belden 9913 or better with a maximum attenuation of 4.2 dB per 100 feet @ 900 MHz.

An interconnect cable, 4-foot minimum, shall be provided with the spread spectrum equipment for interconnecting directly with the local controller.

2.5.7 Lightning Suppressor:

A cabinet mounted lightning suppressor shall be provided as part of the spread spectrum radio system.

2.6 TS-2 TYPE 2 CONTROLLER

2.6.1 INTRODUCTION

This specification sets forth the minimum requirements for a shelf-mountable, 2 to 12 (minimum) phase, 2 (minimum) ring, actuated, digital, solid-state traffic controller unit. The controller unit shall meet, as a minimum, all applicable sections of the NEMA Standards Publication No. TS 2-1998, Traffic Controller Assemblies with NTCIP Requirements, where differences occur, this specification shall govern. The controller version shall be NEMA TS 2 Type A2N (Actuated, Type 2, and NTCIP).

2.6.2 ENERAL REQUIREMENTS

2.6.2.1 Through certification by an independent testing facility, the controller assembly shall have successfully demonstrated compliance with the testing requirements of Section 2 – Environmental Requirements, of the above referenced NEMA Standard.

2.6.2.2 The controller shall be compliant with the National Transportation Communication for ITS Protocol (NTCIP). At the application layer, the controller shall utilize the Simple Transportation Management Protocol (STMP) for

communication between the controller and central system. The controller shall be compliant with Conformance Level 2 of the Simple Transportation Management Framework as specified in NTCIP 1101. Within the provisions of the NTCIP 1101 specification, dynamic data objects shall be utilized for the efficient use of communication bandwidth.

The controller shall conform to the following stack, defined using the NTCIP 2001 Class B Profile:

2.6.2.2.1 Information Level: Data Objects;
2.6.2.2.2 Application Level: STMP;
2.6.2.2.3 Transport Level: Null;
2.6.2.2.4 Subnetwork Level: Point to Point Protocol (PPP), Point to Multi-Point Protocol (PMPP), Frequency Shift Keying (FSK) Modem, and V-Series Modem (where applicable); and
2.6.2.2.5 Plant Level: Fiber, Twisted Pair, Telco Line, and Wireless.

2.6.2.3 At the data layer and where possible, the controller shall utilize objects defined by NTCIP 1201 and 1201A – Global Object Definitions; and NTCIP 1202 – Object Definitions for Actuated Signal Controllers (ASC). Documentation provided with the controller, as part of the electrical submittal, shall fully describe the contents of all dynamic objects. For each object within the collection, this description shall include the object name, object data type, and the relative location of the object within the dynamic object collection. The object name shall be the name specified by either the Global Object Definitions or Object Definitions for ASC. Any vendor-defined objects shall be described in the documentation. This documentation shall include a functional description of the object and any encoding associated with the object. The documentation shall describe any constraints related to the communication protocol including but not limited to message timing, and message sequencing.

At a minimum, the controller shall support a communication protocol that provides the following functional system interface:

2.6.2.3.1 Once per second poll response containing alarm status, current timing plan, and phase status;
2.6.2.3.2 Periodic timing plan command allowing the central system to select a timing-plan for operation in the controller;
2.6.2.3.3 Periodic event commands that allow the central system to set special function outputs;
2.6.2.3.4 Periodic time broadcast command allowing the central system to set the clock in the controller. The broadcast command will not be address specific. Any controller that receives a properly formatted message will accept the command;
2.6.2.3.5 Periodic time upload request allowing the central system to monitor the controller clock;
2.6.2.3.6 Once-per-second detailed operations request allowing the central system to monitor the local cycle counter, vehicle, pedestrian, and overlap indications; hold, force-off, and omit states; vehicle and pedestrian calls, and special function outputs;
2.6.2.3.7 Periodic uploads of detector data including volume and occupancy. The controller shall accumulate detector data locally for a period between 1 and 5 minutes. The accumulated data shall be available to upload for a period equal to the accumulation interval. It shall be possible for the central system to determine the availability of new data;

2.6.2.3.8 Once-per-second input/output request allowing the central system to monitor the state of controller input/output;

2.6.2.3.9 Periodic database-download commands allowing the central system to download database parameters. The protocol shall support the download of all controller database elements;

2.6.2.3.10 Periodic database-upload requests allowing the central system to upload database parameters. The protocol shall support the upload of all controller database elements; and

2.6.2.3.11 Periodic split monitor request allowing the central system to upload split data accumulated by the controller on a cycle basis.

2.6.2.4 MCDOT is procuring central signal system software under a separate contract. The documentation supplied in 2.6.2.3 will be used by MCDOT's Central Signal system software supplier/integrator to develop a NTCIP interface to the controller. The successful controller vendor shall cooperate fully with MCDOT and the supplier of the central signal system software to develop this NTCIP interface to the controller. This cooperation, including the explicit documentation as outlined in 2.6.2.3 is mandatory.

2.6.3 ENCLOSURE

2.6.3.1 The enclosure shall be constructed of anodized aluminum and shall be finished with an attractive, durable protective coating. Model number, serial number, and program information shall be permanently displayed on the enclosure.

2.6.3.2 The enclosure shall provide a stainless steel hinged opening to provide access to the internal electronic modules. Tools shall not be required to gain access to these modules. The enclosure shall be designed for easy access during maintenance, allowing for testing without requiring disassembly or extender boards.

2.6.4 ELECTRONICS

2.6.4.1 A microprocessor shall be used for all timing and control functions. Continuing operation of the microprocessor shall be verified by an independent monitor (watchdog) circuit, which shall set an output to FALSE and indicate an error message if a pulse is not received from the microprocessor within a defined period.

2.6.4.2 A built-in, high-efficiency switching power supply shall generate all required internal voltages. All voltages shall be monitored with control signals. The power supply shall be removable without the use of tools.

2.6.4.3 A 10-year lithium battery shall maintain the time-of-day clock and digital data during a power outage lasting up to 30 days. Lead-acid, nickel-cadmium, or alkaline batteries shall not be acceptable.

2.6.4.4 All printed circuit boards (PCBs) shall meet the requirements of the NEMA TS 2-1998 Standard plus the following requirements to enhance reliability:

2.6.4.4.1 All plated-through holes and exposed circuit traces shall be plated with solder;

2.6.4.4.2 Both sides of the PCB shall be covered with a solder mask material;

2.6.4.4.3 The circuit reference designation for all components and the polarity of all capacitors and diodes shall be clearly marked adjacent to the

component. Pin 1 for all integrated circuit packages shall be designated on all printed circuit boards; and

2.6.4.4.4 All electrical mating surfaces shall be gold-plated.

2.6.5 FRONT PANEL

2.6.5.1 The front of the controller shall consist of a panel for the display and keyboard plus a separate panel for the connectors.

2.6.5.2 A minimum 8-line by 40-character/line alphanumeric liquid crystal display (LCD) shall show program and status information. For ease of viewing, backlighting and multiple levels of contrast adjustment shall be provided.

2.6.6 OPERATING DISPLAYS

2.6.6.1 Dynamic displays shall be provided to show the operational status of the controller. Additional displays shall be offered for programming. It shall be possible to place vehicle, pedestrian and preemption calls from the keyboard while displaying status information. These dynamic screens shall be capable of displaying, as a minimum, the following information listed (not necessarily on one active screen):

2.6.6.1.1 Current timing plan in effect;
2.6.6.1.2 Phases and overlap R, Y, G, W, DW indications;
2.6.6.1.3 Per phase vehicle and pedestrian demand;
2.6.6.1.4 Current timing interval values or rest states;
2.6.6.1.5 Local and master cycle timers and offset timers;
2.6.6.1.6 Status of each of the force off and permissive;
2.6.6.1.7 Mode of selection of cycle, split and offset;
2.6.6.1.8 Sync status;
2.6.6.1.9 Overlap card programming;
2.6.6.1.10 Volume density current timing values;
2.6.6.1.11 Time base status display shall indicate current time and date, the current day and week program, show active circuits and patterns;
2.6.6.1.12 Coordinator status display shall indicate the command source, current coordination pattern information, local/system cycle count, command/actual offset, offset correction;
2.6.6.1.13 Status of all phase inputs including: vehicle calls, pedestrian calls, omits, pedestrian omits, and hold;
2.6.6.1.14 Status of all phase outputs including green, yellow, red, walk, don't walk, phase next, phase on, and check;
2.6.6.1.15 Status of the overlap outputs;
2.6.6.1.16 Status of per ring inputs and outputs, including: Max 2, force off, stop timing, inhibit max termination, red rest mode, ped recycle, and omit red clear;
2.6.6.1.17 Status of all per unit inputs and outputs including: Interval advance, manual control enable, call to non- actuated, walk rest modifier, min recall, test input A and B, flashing logic output;
2.6.6.1.18 Status of all auxiliary I/O provided by the unit;
2.6.6.1.19 Status of all detector activity;
2.6.6.1.20 Telemetry status to indicate last command received, status of last command transmitted, master polling timer and transmit status;
2.6.6.1.21 When MOE's are in use, the volumes, number of force off's, gap-outs, max-outs, walks and speed trap values of the current MOE period;
2.6.6.1.22 Status if either an overlap or EEPROM card is installed; and
2.6.6.1.23 Status of the MMU.

2.6.7 SERVICEABILITY

2.6.7.1 All electronic modules other than the power supply shall be removable from the front of the controller using a standard screwdriver as the only tool. All power and signal connections to the circuit boards shall be via plug-in connectors.

2.6.7.2 The controller layout shall allow the removal and replacement of any circuit board without unplugging or removing other circuit boards. No more than 2 boards shall be attached together to form a circuit assembly. Attaching hardware

shall use captive screws or 1/4-turn fasteners to secure circuit assemblies to the enclosure.

2.6.7.3 The controller enclosure shall allow complete disassembly using a standard screwdriver. It shall be designed so that one side of any circuit board is accessible for troubleshooting and testing while the controller is still in operation. This capability shall be accomplished without the use of extender cards or card pullers.

2.6.8 PROGRAMMING

2.6.8.1 Programming Displays

2.6.8.1.1 Programming displays in the form of menus shall aid the operator in entering data from the front-panel keyboard.

2.6.8.1.2 A main menu shall allow the user to select a major function of the controller. A submenu shall then be displayed to allow the user to select a sub-function within the major function.

2.6.8.1.3 English language and traffic engineering terminology shall be used throughout to facilitate programming. The display organization shall allow traffic personnel to program the controller without using reference cards or manuals.

2.6.8.1.4 Programming entries shall consist of alpha or numerical values. During program entry, the new data shall be displayed as it is entered. Entries shall only be validated and stored when the ENTER ("E") key or the cursor key is pressed.

2.6.8.2 Programming Methods

2.6.8.2.1 The methods listed below shall be available for controller programming. The manufacturer shall be able to provide as off-the-shelf items all of the firmware and software required to effect the listed programming methods and to implement network operation with system masters and host PC's.

2.6.8.2.1.1 Manual data entry via the front panel keyboard;
2.6.8.2.1.2 Data downloading via telemetry from a system master connected to a host PC in a closed-loop system;
2.6.8.2.1.3 Data downloading from a portable PC-compatible computer via null-modem cable;
2.6.8.2.1.4 Data downloading from a PC-compatible computer via modem;
2.6.8.2.1.5 Data downloading from one controller to another using a serial port on each controller; and
2.6.8.2.1.6 Transfer of the EEPROM data module from one controller to another.

2.6.8.3 Programming Security

2.6.8.3.1 The controller unit shall prevent the alteration of keypad set unit variables prior to the user having entered a 4-digit access code. No access code shall be required to display data. Access codes shall initially be set to provide unrestricted access.

2.6.8.4 Programming Utility Functions

2.6.8.4.1 A copy function shall permit copying all timing data from one phase to another. It shall also permit copying all coordination pattern data from one pattern to another. This feature will facilitate data entry when programming any 2 or more phases with the same timing values and/or 2 or more coordination patterns with the same pattern data.

2.6.8.4.2 The controller unit shall contain a backup database stored in nonvolatile memory. A copy function shall permit transferring the backup database to the active database.

2.6.8.4.3 A print function shall allow the printing of controller unit data and detector count, detector failure, and event logs. The controller shall be capable of interfacing with any printer with an RS-232 interface and capable of a minimum width of 80 columns. The printer configuration shall provide user selection of baud rate (1,200 to 19,200).

2.6.8.5 Actuated Control Functions

2.6.8.5.1 The controller shall provide all actuated control functions and operations required by the NEMA TS 2-1998 Standard. In addition, it shall provide the features described in the following paragraphs.

2.6.8.6 Phase Sequence

2.6.8.6.1 The phase sequence of the controller shall be programmable in any combination of all available phases and timing rings.

2.6.8.6.2 Phase sequence information shall be changeable from the keyboard and stored in EEPROM data memory.

2.6.8.6.3 The standard phase sequence of the controller shall be capable of being altered by coordination, time-of-day or external alternate sequence command. The alternate sequence commands shall allow reversing the normal phase sequence of the phase pairs.

2.6.8.7 Timing Intervals

2.6.8.7.1 Timing intervals shall be programmable in most any combination.

2.6.8.7.2 Guaranteed minimum intervals shall be set for all yellow clearance timings (normal and preempt routines).

2.6.8.7.3 The controller shall be capable of alternate passage / maximum timings for each phase. At least 2 alternate passage timings and maximum green timings shall be selectable based on time of day.

2.6.8.7.4 The controller shall be capable of dynamically extending the maximum green time for each phase based on vehicle demand. Up to 3 dynamic maximum green intervals shall be selectable per phase based on time-of-day. The initial interval shall be selectable as either Max 1 or Max 2. If the phase terminates due to max-out for 2 successive cycles, then the maximum green time in effect shall

automatically be extended by one dynamic step interval on each successive cycle until it is equal to the selected Max. If the phase gaps out for 2 successive cycles, then the maximum green time shall be reduced by one dynamic step interval until such subtraction would mean the adaptive max was less than the smaller of the normal max or the dynamic maximum value.

2.6.8.8 Overlaps

Overlaps allow traffic movements during the green intervals of phases and during the clearance intervals between phases.

The controller shall provide 16 internally generated overlaps (A through P). These shall be individually programmable. Each overlap shall be individually programmable from the controller keyboard to enable the green to remain on following termination of the parent phase green (trailing operation). The controller unit timing for the trailing operation shall include green (0-255 seconds, minimum), yellow (0-25.5 seconds minimum) and red (0-25.5 seconds, minimum) timing intervals for each overlap.

2.6.8.9 Conditional Service

Conditional service permits the servicing of odd-numbered (left-turn, for example) phases to be serviced after their normal service interval during the time allotted for the parent phase interval.

The controller shall provide a programmable conditional service feature. When selected, the controller shall service an odd-numbered phase once normal service to that phase has been completed and enough time for additional service exists on the concurrent even phase.

2.6.8.10 Additional Features

2.6.8.10.1 The following features shall be programmable for each phase:

2.6.8.10.1.1 Phase in use;
2.6.8.10.1.2 Locking/non-locking detector memory;
2.6.8.10.1.3 Vehicle recall (Minimum, Maximum, and Soft); and
2.6.8.10.1.4 Pedestrian recall.

2.6.8.10.2 Soft Recall shall return the controller to the programmed phase when a conflicting phase is in green or red dwell and there are no serviceable conflicting calls.

2.6.8.10.3 The controller shall permit power-up start and external start to be programmed by phase and interval. Start intervals shall be green, yellow or red.

2.6.8.10.4 During a power-up start condition; the controller shall be capable of timing an all-red or flash interval before the start phase(s) and interval are displayed.

2.6.8.10.5 The controller shall provide last-car passage operation on a per phase basis. When selected, this feature shall provide a full passage (vehicle extension) interval when a phase gaps out

with a gap in effect less than the vehicle extension interval (preset gap).

2.6.8.10.6 The controller shall provide both single and dual entry operation. When selected, dual entry shall cause the controller to ensure that one phase is timing in each ring.

2.6.8.10.7 The controller shall provide the following additional selectable pedestrian functions:

2.6.8.10.7.1 Actuated phase Rest In Walk;
2.6.8.10.7.2 Flashing WALK output;
2.6.8.10.7.3 Pedestrian clearance protection during manual control; and
2.6.8.10.7.4 Pedestrian clearance through yellow or through yellow and red clear.

2.6.8.10.8 The controller shall provide a programmable simultaneous gap termination feature. When programmed, phases in both rings shall gap out together in order to terminate the green interval and cross the barrier.

2.6.8.10.9 The controller shall provide automatic flash selection. Both the flash entrance and exit phases shall be programmable through the keyboard, and flashing shall be controlled by either setting the voltage monitor output to be FALSE or by flashing through the load switch driver outputs. Automatic flash shall be selectable by external input, system command, or time of day.

2.6.8.10.10 The controller shall provide dimming selectable for all phases and overlaps. Programming shall permit individual dimming of all the Green/Walk, Yellow/Ped Clear and Red/Don't Walk outputs for each load switch. Dimming shall be accomplished by inhibiting the selected outputs for alternate half cycles of the 120 VAC line, and selection of positive or negative half cycles for a signal output shall be determined automatically by the controller unit. Dimming shall be controllable by time of day or external input.

2.6.9 COORDINATION

Coordination functions to control intersection cycle lengths, system offset relationships, and phase split percentages shall be provided as a standard feature, with no need for additional modules or software.

2.6.9.1 Coordination Modes

2.6.9.1.1 The normal coordination mode shall be selectable via keyboard entry. Each pattern shall be capable of overriding the normal coordination mode with an individually selectable coordination mode for that pattern.

2.6.9.1.2 Permissive Mode – The coordinated phase(s) shall operate as non-actuated when coordinated. The coordinator shall provide for a controlled release (permissive period) from the coordinated

phase(s) to each of the remaining phases in sequence. When a call is not present for the phase to be serviced next in sequence, the coordinator shall re-allocate that phase's time to the end of the coordinated phase.

The first part of each permissive period shall consist of a vehicle permissive period. The length of the period shall be determined by the phase split and the vehicle minimum service time.

The second part of each permissive period shall consist of a pedestrian permissive concurrent with the vehicle permissive. The length of this period shall be determined by the phase split and the pedestrian minimum service time.

Prior to the beginning of the first permissive period, the coordinated phase pedestrian shall display the Pedestrian Clear indication and dwell Don't Walk. This will expand each subsequent phase permissive due to the absence of coordinated phase Pedestrian Clear time in each. The coordinated phase pedestrian shall dwell Don't Walk until such time as the coordinated phase terminates and returns to Green or the last permissive period in the cycle is complete without the coordinated phase terminating.

2.6.9.1.3 Yield Mode – The coordinated phases(s) shall operate as non-actuated when coordinated. The coordinator shall provide for a single release from the coordinated phases(s) to the remaining phases in sequence.

2.6.9.1.4 Permissive Yield Mode – The operation shall be similar to Permissive Mode above with the following exceptions:

2.6.9.1.4.1 The coordinated pedestrian phase shall be actuated;

2.6.9.1.4.2 Immediately prior to the first permissive, the coordinator will provide a variable period for the coordinated phase extension (Permissive Yield Point); and

2.6.9.1.4.3 The amount of coordinated phase extension shall be distributed proportionally.

2.6.9.1.5 Permissive Omit Mode – The operation shall be equal to Permissive Yield Mode above except that once the coordinated phase has terminated to service a call, it shall not occur again until after the last phase permissive has terminated or a phase is on that is compatible with the coordinated phase.

2.6.9.1.6 Sequential Omit Mode – The operation shall be equal to Permissive Yield Mode with the following exceptions:

2.6.9.1.6.1 `Sequential Omit Mode provides a phase` by phase sliding window of service (lifted omit). One and only one phase in a ring will have the omit lifted at any time;

2.6.9.1.6.2 Following the Permissive Yield Period, the coordinated phase shall be omitted until the last permissive is over;

2.6.9.1.6.3 Following the Permissive Yield Period, the opening of a permissive shall occur concurrent with the closing of the prior permissive. The closing of each permissive shall occur at its normal position in the cycle; and

2.6.9.1.6.4 A limitation shall be set on Sequential Omit mode in that it shall apply only to controller units running with no more than 2 rings in a cluster.

2.6.9.1.7 Full Actuated Mode – the operation shall be as defined in Permissive Yield Mode with the following exceptions:

2.6.9.1.7.1 Following the Permissive Yield Period, any phase may be served in the standard sequence provided the permissive period for that phase has not expired;

2.6.9.1.7.2 Following the Permissive Yield Period, any phase may be reserviced in the standard sequence provided the permissive period for that phase has not expired; and

2.6.9.1.7.3 Following the Permissive Yield Period and prior to the end of the permissive for the phase before the first coordinated phase, the coordinated phase shall operate as an actuated phase.

2.6.9.1.8 It shall be possible to select from a minimum of four (4) unique Timing Plans. The Timing Plans shall be selected using telemetry (system), hardwire, or non-interconnected (time base) commands.

2.6.9.2 Cycle Length

2.6.9.2.1 One cycle length shall be provided for each Timing Plan. The cycle shall be adjustable over a range of 30-255 seconds in 1-second increments.

2.6.9.3 Synchronization

2.6.9.3.1 For systems with a single system sync pulse, coordination timing shall be synchronized to the leading edge of that pulse, which shall serve as the master zero reference for all offset timing.

2.6.9.3.2 For hardwire systems with multiple sync pulses, the coordinator shall lock onto the correct sync by checking for reoccurrence based on the running cycle length.

2.6.9.3.3 After a valid system sync pulse has been received the coordinator shall check for the proper occurrence of the system sync pulse during each subsequent cycle. If a sync pulse does not occur for 2 consecutive cycles, the coordinator shall revert to the non-interconnected coordination mode.

2.6.9.4 Offset

2.6.9.4.1 Offset shall normally be defined as the time period from the system sync pulse to the beginning of the leading coordinated phase green (local zero). The coordinator shall also be capable of referencing the offset to the end of the coordinated phase green.

2.6.9.4.2 Offsets shall be programmable in seconds. The range shall be from 0-254 seconds in 1-second increments. The coordinator shall provide 3 offsets per Timing Plan.

2.6.9.4.3 Offset changes shall be achieved by adding or subtracting cycle time over multiple cycle periods to allow a smooth transition to the new offset. Offset correction using dwell shall also be selectable.

2.6.9.5 Split

2.6.9.5.1 There shall be a set of phase allocations for all phases in a split plan. The split interval shall be programmable using seconds. The range shall be from 0-254 seconds in 1-second increments.

2.6.9.5.2 Split interval settings shall determine the maximum time, including vehicle clearance (yellow and red), for a non-coordinated phase, or the minimum time for a coordinated phase.

2.6.9.5.3 The controller unit shall provide a ‘fixed’ forced mode that terminates a phase based on the plan timing via keyboard entry. Each phase shall be forced the split time after it becomes active to enable all unused time phase by phase to the beginning of the coordinated phase.

2.6.9.5.4 The controller unit shall provide a ‘floating’ force mode that terminates a phase based on the cycle timing via keyboard entry. Each phase shall be forced at a fixed position in the background cycle to enable unused time phase by phase to the next phase that has vehicle traffic that is capable of taking it.

2.6.9.6 Transition Cycles

2.6.9.6.1 The controller shall provide a smooth and orderly transition when changing from free operation to coordinated operation and from one coordination command to another.

2.6.9.6.2 During a free-to-coordinated transition, the controller shall initiate a pick-up cycle beginning upon receipt of a valid coordination command. The controller shall then enter coordination mode at the beginning of the coordinated phase greens.

2.6.9.6.3 Each coordination command shall select a cycle, offset and split. Cycle, offset and split changes shall not take effect until local zero.

2.6.9.7 Local Split Demand

2.6.9.7.1 The coordinator shall provide a minimum of 2 queue selection routines (4 detectors per routine assigned from system detectors) which shall allow the selection of a preferred coordination pattern based upon intersection demand.

2.6.9.8 Free Mode

2.6.9.8.1 The coordinator shall provide a free mode of operation, where all coordination control is removed.

2.6.9.8.2 Free mode operation shall be selectable by coordination commands, by external input or by keyboard entry.

2.6.9.8.3 The coordinator shall revert to the free mode when active controller inputs or functions would interfere with coordination. Such inputs or functions shall include the following:

2.6.9.8.3.1 Manual control enable;
2.6.9.8.3.2 Stop time;
2.6.9.8.3.3 Automatic flash; and
2.6.9.8.3.4 Preemption.

2.6.9.9 Manual Control

The controller shall allow manual override of the current coordination command from the keyboard. The manual command shall allow selection of any coordination pattern to be in effect.

2.6.9.10 Interconnect Modes

2.6.9.10.1 The coordinator shall be capable of operating with any of the following interconnect types:

2.6.9.10.1.1 Wireless;
2.6.9.10.1.2 Non-interconnected coordination (time-based); and
2.6.9.10.1.3 Hardwired.

2.6.9.10.2 The coordinator shall be compatible with fixed-time interconnect, which provides the sync pulse superimposed on the offset lines. The non-interconnected coordination mode shall serve as a backup when using telemetry or hardwired interconnect.

2.6.9.11 Master Coordinator

The coordinator shall output the coordination command, including sync pulse. This feature shall permit the controller to be used as a time-of-day master in a hardwired interconnected system.

2.6.10 PREEMPTION

The controller shall provide a minimum of 6 preemption sequences. Preemption capability shall be standard and shall not require additional modules or software.

2.6.10.1 The 6 preemptors shall be selectable as to priority one to another and any preempt to automatic flash.

2.6.10.2 Each preemptor shall provide a locking and non-locking memory feature for preemptor calls. If a preemptor is in the non-locking mode and a call is received and dropped during the delay time, the preemptor shall not be serviced.

2.6.10.3 Preemptor timing intervals shall be programmable from 0-255 in one second increments or 0-9.99 in one-tenth second increments, depending on function.

2.6.10.4 A programmable delay time interval shall be provided to inhibit the start of the preemption sequence. This time shall be programmable from 0-255 in one second increments. This interval shall begin timing upon receipt of a preemption call.

2.6.10.5 A programmable extend time shall be provided to stretch the call duration from the point of termination of the actuation. This time shall be programmable from 0-255 in one second increments.

2.6.10.6 A programmable duration time shall be provided to control the minimum time that a preemptor remains active. This time shall be programmable from 0-255 in one second increments.

2.6.10.7 A programmable maximum call time shall be provided to control the maximum time that a preemptor remains in control. This time shall be programmable from 0-255 in one second increments. The preemptor maximum call time interval shall be inhibited when set to zero.

2.6.10.8 Signal displays in effect at the beginning of a preemption sequence shall not be terminated unless the respective green/walk has been in effect for a minimum time. If the respective green/walk has been active for longer than the programmed minimum GREEN/WALK time, the controller unit shall immediately advance to the next interval. Minimum times shall be programmable for the GREEN/WALK interval on a per ring basis. This time shall be programmable from 0-255 in one second increments.

2.6.10.9 A phase shall advance to pedestrian clearance if it has timed the minimum GREEN/WALK interval at the beginning of a preemption sequence. The programmed preempt pedestrian clearance will then be timed. During preemption pedestrian signals shall be individually selectable as being a solid DON'T WALK, solid WALK, flashing WALK, OFF (blank), or cycling (dwell).

2.6.10.10 During preemption vehicle signals (phase and overlap) shall be individually selectable as being a solid Red, solid green, flashing Red, flashing Yellow, or cycling (dwell).

2.6.10.11 Exit phases shall be selectable to time after the preemption sequence has been completed. These shall serve as transition phases to return the controller to normal operation. It shall also be possible to place calls on selected phases upon exiting preemption.

2.6.10.12 Preemptor linking shall permit preemption sequences, where lower-priority preemptors may call the higher-priority preemptors upon termination of their preemption sequence.

2.6.10.13 Preemptor active outputs shall be provided for each of the preemptors.

2.6.11 TIME-BASED CONTROL & NON-INTERCONNECTED COORDINATION

2.6.11.1 The controller shall include time-based control. This capability shall be a standard feature and shall not require additional modules or software.

2.6.11.2 Clock/Calendar Functions

2.6.11.2.1 The controller shall provide a time-of-day (TOD) clock, which shall be used for all time-based control functions. The only required clock settings shall be the current time (hour, minute and second) and date (month, day and year).

2.6.11.2.2 During normal operation, the TOD clock shall use the power line frequency as its time base. When power is removed, the time shall be maintained by a crystal oscillator for up to 30 days. In the battery backup mode time is maintained to within +/- 0.005% as compared to WWV time standard.

2.6.11.2.3 In addition to entering time and date via the keyboard, it shall be possible to download the information from another controller, a computer or a system master.

2.6.11.2.4 The controller shall include a time reset input. This feature shall reset the TOD clock to 03:30:00 whenever the time reset input is TRUE.

2.6.11.2.5 The TOD clock shall automatically compensate for leap year and shall be programmable to automatically switch to daylight savings time. The TOD clock shall ignore daylight savings time as a default.

2.6.11.2.6 The TOD clock shall not be subject to disruption due to year numbering formats or date formats.

2.6.11.3 Time-Base Control

2.6.11.3.1 A minimum of 220 different traffic and/or auxiliary events shall be capable of being programmed over a 99-year time frame.

2.6.11.3.2 A program day is the list of traffic and/or auxiliary events to occur in a 24-hour period. The TBC program shall provide for 50 program days to be defined.

2.6.11.3.3 The normal day-of-week (Sunday through Saturday) event listing will utilize program days 01 through 07 with Sunday being program day 01.

2.6.11.3.4 Selection of TBC on-line by external input shall allow the coordination pattern selected by the hardwire system to override the current TBC coordination pattern.

2.6.11.3.5 When operating in the non-interconnected coordination mode the synchronization point for all cycles shall be referenced to a user selected reference time (hour and minute) or the event time. The sync reference time is that time from which all cycle zeros shall be calculated. The synchronization point for the cycle selected by the current event, shall be computed using the present time, sync reference time, and cycle length. The synchronization point shall occur whenever the present time is such that an even number of cycle length periods have occurred since the sync reference time.

2.6.12 DETECTORS

2.6.12.1 The controller shall provide a minimum of 64 vehicle detector inputs. Each input shall be assignable to any phase and be programmable as to detector function.

2.6.12.2 The controller shall provide detector cross switching, which permits all vehicle detectors to alternately place calls on their assigned phases and their assigned cross-switch phases. If the assigned phase is not green and the cross-switch phase is green, the detector shall place calls on the cross switch phase.

2.6.12.3 Each detector input shall be capable of functioning as one of 8 (minimum) system detectors.

2.6.12.4 Vehicle detectors shall be capable of being assigned to a minimum of 2 speed detectors.

2.6.12.5 The controller shall provide a minimum of 8 pedestrian detector inputs. Each pedestrian detector shall be assignable to any phase.

2.6.13 SYSTEM COMMUNICATIONS

2.6.13.1 The controller shall be capable of communicating with an on-street system master or directly to a central office computer-based system master. This capability shall be provided by an external modem that is included as a separate specification.

2.6.13.2 System Commands

The controller shall receive, via an interface to an external modem, as a minimum, the following commands:

2.6.13.2.1 Cycle, offset, and split (coordination pattern);
2.6.13.2.2 Timing parameter downloading and verification;
2.6.13.2.3 Special function commands (minimum of 4);
2.6.13.2.4 Free and flash mode commands;
2.6.13.2.5 Time and date; and
2.6.13.2.6 Request for local status.

In the absence of being polled by the master, within a defined period, the local will revert to backup TBC and coordination mode. When again polled by the master the local will return to the system mode and transition to the master-called program.

2.6.13.3 Status Data

The status of each of the following functions shall be transmitted on a second-by-second basis to the system master in response to a local status request:

2.6.13.3.1 Green and yellow status for all phases and overlaps;
2.6.13.3.2 Walk and pedestrian clearance status for all phases;
2.6.13.3.3 Vehicle and pedestrian detector status;
2.6.13.3.4 Phase termination status;
2.6.13.3.5 Local time;
2.6.13.3.6 Coordination status;
- 2.6.13.3.6.1 Command source;
- 2.6.13.3.6.2 Sync or transitioning status of coordinator;

2.6.13.3.7 Conflict flash status;
2.6.13.3.8 Local flash status;
2.6.13.3.9 Preempt activity and calls;
2.6.13.3.10 Volume and occupancy data from a minimum of 8 system detectors;
2.6.13.3.11 Speed data from a minimum of 2 speed detectors; and
2.6.13.3.12 Status of user-defined alarms.

2.6.13.4 Upload/Download Capability

The external modem shall provide the capability to upload/download the entire intersection database. Phase assignments for overlaps and preemptors shall not be downloaded to preclude unsafe controller operation.

2.6.14 LOGGING

2.6.14.1 The controller shall include a communications fault log capable of storing a minimum of 60 time and date-stamped communications fault events. Once logged, communications fault events shall remain in the log until cleared or the log capacity is exceeded at which time the oldest communications fault events shall be overwritten.

2.6.14.2 Event Log. The controller shall be capable of storing a minimum of 120 events in this log. The oldest logs shall be replaced first if memory overflows. The events that shall be reportable are listed as follows:

2.6.14.2.1 Checksum Failure;
2.6.14.2.2 Manual Control Enable Active;
2.6.14.2.3 Conflict Monitor Flash;
2.6.14.2.4 Uniform Code Flash;
2.6.14.2.5 Soft Flash;
2.6.14.2.6 Cabinet Flash;
2.6.14.2.7 User definable Alarms 1-8;
2.6.14.2.8 Preemption Active By Run;
2.6.14.2.9 Detector Failure By Channel;
2.6.14.2.10 Self Test Diagnostics Failure;
2.6.14.2.11 Cycling Fault;
2.6.14.2.12 Cycling Failure;
2.6.14.2.13 Coordination Fault;
2.6.14.2.14 Coordination Failure;
2.6.14.2.15 Cabinet Door Open;

2.6.14.2.16 Watchdog Failure;
2.6.14.2.17 I/O Failure;
2.6.14.2.18 Start-up Failure;
2.6.14.2.19 Preempt Active at Startup;
2.6.14.2.20 UCF Active at Startup;
2.6.14.2.21 EEPROM Module Failure;
2.6.14.2.22 Time Base Coordination Enable; and
2.6.14.2.23 Reset Real Time Clock.

2.6.14.3 Event Call In. The controller shall allow the user to program certain events to be immediately reported as soon as they occur. The events that shall be programmable to operate in this mode are as follows:

2.6.14.3.1 On/off status of user definable Alarms 1-8;
2.6.14.3.2 Time Base Control;
2.6.14.3.3 Reset Real Time Clock;
2.6.14.3.4 Checksum Failure;
2.6.14.3.5 Start-up Failure;
2.6.14.3.6 Conflict Monitor Flash;
2.6.14.3.7 Detector Failure;
2.6.14.3.8 Coordination Failure;
2.6.14.3.9 Cycling Failure;
2.6.14.3.10 Cabinet Open;
2.6.14.3.11 Diagnostics Failure;
2.6.14.3.12 Manual Control Enable;
2.6.14.3.13 Uniform Code Flash;
2.6.14.3.14 Soft Flash;
2.6.14.3.15 Keyboard Load;
2.6.14.3.16 Cabinet Flash;
2.6.14.3.17 Preempt Active by Run;
2.6.14.3.18 Power Up; and
2.6.14.3.19 Download Request.

2.6.14.4 Measure of Effectiveness (MOE). MOE data shall be collected a user settable sampling period, that can be up to 20 days. The MOE log data collection shall be enabled by a time of day circuit.

2.6.14.5 The MOE log sampling period shall be a user selected period that is divisible onto 60 and shall be synchronized with the real time, i.e., 1, 5, 10,15, 30, 60 minutes periods.

2.6.14.6 MOE Storage capacity. The controller unit shall be capable of storing a minimum of 24 MOE logs. Logs shall be retained for a minimum of 100 hours without power applied to the unit. Oldest logs shall be replaced first if memory overflows. MOE reports shall consist of a minimum of the following items collected each sampling period.

2.6.14.6.1 Date and time of day of record;
2.6.14.6.2 Number of whole cycles;
2.6.14.6.3 Sample period;
2.6.14.6.4 Active Cycle/Offset/Split/ Mode (System or Free);
2.6.14.6.5 Active Cycle/Offset/Split Pattern;
2.6.14.6.6 Seconds average green used per phase per cycle;
2.6.14.6.7 Maximum Green available per phase per cycle based on split or max;
2.6.14.6.8 Phase Green Utilization as a percentage of available green;

2.6.14.6.9 Seconds of average delay per phase;
2.6.14.6.10 Number of Walk's per phase per period;
2.6.14.6.11 Number of Gap-out's per phase per period;
2.6.14.6.12 Number of Force off's per phase per period;
2.6.14.6.13 Number of Max-out's per phase per period;
2.6.14.6.14 Average headway for up to 16 detectors;
2.6.14.6.15 Occupancy for up 16 detectors; and
2.6.14.6.16 True speed for up to 4 speed traps.

2.6.14.7 The number of cycles plus the active cycle, split, offset, system status (system or free) shall be stored as part of the record for the MOE's.

2.6.14.8 Green Utilization computation. If in system mode, green utilization shall be determined by dividing the average actual green time by the programmed split allocated time, resulting in an average percentage of the green used. If in free operation, green utilization shall be calculated by dividing the actual green by the current max value. The measured green utilization data shall be averaged per phase over the number of cycles.

2.6.14.9 Average Headway. Headway shall be determined from detectors 1-16. The log shall indicate the time, in tenths of a second between calls on a particular detector over it's sampling period. The detector values shall be averaged over the sample period.

2.6.14.10 Occupancy. Occupancy shall be determined from detectors 1-16. The log shall indicate, the occupancy, as a percentage of the actual sampling period, regardless of phase indications for a particular detector.

2.6.14.11 Speed Traps. True speed shall be determined from speed traps and shall be a measure of "true" speed, i.e., a calculation of the travel time from a "Leading" to a "Trailing" detector. The unit shall be capable of a minimum of 4 speed traps. The selected speed trap values shall be averaged over the sample period.

2.6.14.12 Volume logs. The controller shall be capable of storing detector volume log data. Volume logs shall be collected at the end of a sampling period. Sampling period range can be up to 32 days. These logs shall be time stamped and consist of data accumulated from detectors 1-32. The volume log data collection shall be enabled by a time of day circuit.

The Volume Log sampling period shall be a user selected period that is divisible into 60 and shall be synchronized with the real time. The controller shall allow for storage of up to 32 days of volume logs.

2.6.14.13 Detector Failure Logs. The controller shall be capable of creating a log of detector failures. For all 64 detectors the following types of failures shall be logged:

2.6.14.13.1 Absence of calls;
2.6.14.13.2 Locked calls;
2.6.14.13.3 Erratic or chattering inputs;
2.6.14.13.4 Open Loop;
2.6.14.13.5 Shorted Loop; and
2.6.14.13.6 Excess change.

Minimum presence failure is required to be logged for 32 detectors. The log shall contain 204 events and shall replace the oldest log if the memory overflows.

2.6.14.14 Keyboard Log. The controller shall be capable of printing a log of the keyboard access to the controller. This log shall contain as a minimum a list of the last 30 keyboard security code entries. The log shall list whether a restricted or supervisory security code was entered.

2.6.14.15 Pattern Change Log. The controller shall be capable of printing a log of pattern changes. This log shall contain as a minimum a list of the 120 most recent changes in coordination status including transitions from free to coordination.

2.7 TS2 TYPE 1 CABINET ASSEMBLY

2.7.1 GENERAL

This specification sets forth the minimum requirements for a TS2 Type 1-traffic control cabinet assembly. The cabinet assembly shall meet, as a minimum, all applicable sections of the NEMA Standard Publication No. TS2- 1998. Where differences occur, this specification shall govern.

2.7.2 DESIGN AND CONSTRUCTION

2.7.2.1 The cabinet assembly shall be supplied with proper mounting hardware for foundation mounting.

2.7.2.2 All cabinets shall be supplied with a removable shelf. The shelf shall be secured to the interior of the cabinet by bolts. The shelf shall not restrict the free flow of cabinet ventilating air.

2.7.2.3 The MAIN door and police door-in-door shall close against weatherproof and dust-proof, closed-cell neoprene gasket seal.

2.7.2.4 The MAIN door shall include a mechanism capable of holding the door open at 90 and 150 degrees under windy conditions.

2.7.2.5 Each cabinet shall be supplied with an aluminum document holder. The minimum size of the holder shall not be less than 11 inches wide by 10 inches high by 1 ¼ inches deep. The document holder shall be mounted on the right side of the interior of the cabinet. The opening of the document holder shall face the door.

2.7.2.6 The main door shall include a self-locking tumbler-style lock (Corbin 1548-1 or equivalent). Two keys shall be furnished with each cabinet. It shall not be necessary to use the key to lock the main cabinet door when closing the door.

2.7.2.7 The police door shall include a Corbin R357SG series or equivalent lock with a key hole cover. Two keys shall be furnished with each cabinet.

2.7.3 ELECTRICAL DEVICES

2.7.3.1 The main panel shall be fully wired in each cabinet that is supplied.

The police panel shall include the following switches:

a. Signals switch (on-off);

b. Flash switch (on-off) – in the flash position, power shall not be removed from the controller and stop time shall not be applied;
c. Manual control switch (manual-auto); and
d. Two-position terminal block (for connecting police push button switch).

The technician panel shall include the following switches (all switches shall be toggles):

a. Flash switch (auto-flash);
b. Controller switch (on-off);
c. Stop time switch (on-off); and
d. Luminaire switch (photo off-manual).

2.7.3.2 The controller and cabinet shall include detector isolation functionality with momentary on-off functionality so that vehicle or pedestrian output from loops or pushbuttons can be isolated and turned off. Each separate vehicle and pedestrian phase shall be capable of being isolated.

2.7.3.3 The cabinet shall include a rapid starting fluorescent lamp. The lamp shall be triggered by door opening. The lamp shall be on while the main door is open and off when the main door is closed. The light fixture or the fluorescent tube shall not interfere with placement or removal of any control equipment.

2.7.3.4 The power panel shall include the following breakers:

2.7.3.4.1 For 2-phase cabinets, 30-Amp signal main circuit breaker with 10,000-Amp interruption capacity. Auxiliary equipment on 15-Amp circuit breaker with 5,000-Amp interruption capacity; and

2.7.3.4.2 For 8-phase cabinets, 50-Amp signal main circuit breaker with 10,000-Amp interruption capacity. Auxiliary equipment on 15-Amp circuit breaker with 5,000-Amp interruption capacity.

2.7.3.5 The main breaker shall supply power to the controller, malfunction management unit, signals, cabinet power supply and panels. When referring to circuit breakers, auxiliary equipment includes GFI convenience outlet, cabinet lamp, and cabinet ventilating fan.

2.7.3.6 The cabinet shall include a Radio Interference Suppressor. The suppressor's range shall be a minimum of 50dB over the frequency range of 200 kHz to 75 MHz measured at 50 ohms.

2.7.3.7 The load side of the main circuit breaker shall be protected by a 2 stage lightning surge suppressor, with LED indication along with a set dry contacts for alarm capabilities to indicate proper operation.

The back panel assembly shall include at a minimum the following equipment:

2.7.3.7.1 Load switch sockets;
2.7.3.7.2 Flasher sockets;
2.7.3.7.3 Flash transfer relay sockets;
2.7.3.7.4 Connector cable and pin-out terminal blocks; and
2.7.3.7.5 Support brackets for each load switch and flasher.

2.7.3.8 The back panel shall be removable for field repair. The back panel terminals shall be accessible with all cabinet components installed.

2.7.4 CABINET WIRING METHODS

2.7.4.1 Electrical requirements, cabling, supporting terminal facilities and labeling, among other requirements, shall conform to Section 5, Terminals and Facilities, of NEMA TS 2-1998.

2.7.4.2 A Ground Fault Circuit Interruption (GFCI) duplex receptacle shall be mounted and wired in the lower right side wall of the cabinet. An additional duplex receptacle shall be mounted and wired in the upper left side of the cabinet. These receptacles shall be wired on the load side of the 15-Amp auxiliary equipment circuit breaker.

2.7.4.3 All exposed AC wiring points shall be covered with a clear non-conductive plastic cover to prevent accidental contact, except for wiring at terminal strips.

2.7.4.4 Each cabinet shall be delivered with wiring diagrams, instructional manuals, and a parts list including part numbers.

2.7.5 AUXILIARY DEVICES

2.7.5.1 Load Switches

2.7.5.1.1 Load switches shall be solid state and shall conform to the requirements of Section 6.2 of the NEMA TS 2-1998 Standard.

2.7.5.1.2 Signal load switches shall have a minimum rating of 10 amperes at 120 VAC for an incandescent lamp load.

2.7.5.1.3 2The full complement of load switches shall be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

2.7.5.2 Flashers

2.7.5.2.1 The flasher shall be solid state and shall conform to the requirements of section 6.3 of the NEMA TS 2-1998 Standard.

2.7.5.2.2 Flashing of field circuits for the purpose of intersection flash shall be accomplished by a separate flasher.

2.7.5.2.3 The flasher shall be rated at 15 amperes, double pole with a nominal flash rate of 60 FPM.

2.7.5.3 Flash Transfer Relays

2.7.5.3.1 All flash transfer relays shall meet the requirements of Section 6.4 of the NEMA TS 2-1998 Standard.

2.7.5.3.2 The full complement of relays shall be supplied with each cabinet to allow for maximum phase utilization for which the cabinet is designed.

2.7.5.4 Loop Detector Units

2.7.5.4.1 All loop detector units shall meet the requirements of Section 6.5 of the NEMA TS 2-1998 Standard.

2.7.5.4.2 Eight loop detector units shall be supplied with each 2-phase cabinet supplied. Twelve loop detector units shall be supplied with each 8-phase cabinet supplied.

2.7.5.5 Malfunction Management Units (MMU)

2.7.5.5.1 The MMU shall conform to the requirements of Section 4, Malfunction Management Unit, of NEMA TS 2-1998.

2.7.5.5.2 Each cabinet shall be supplied with a functionally wired 16 channel signal MMU.

2.7.5.5.3 All MMU's shall be functionally wired to utilize their maximum capability.

2.7.5.5.4 The MMU wiring shall be attached to all connections in such a manner that allows removal of each individual wire with a screwdriver, without removing other components.

2.7.5.6 Bus Interface Units (BIU)

2.7.5.6.1 All BIUs shall meet the requirements of Section 8 of the NEMA TS2 Standard.

2.7.5.6.2 2.7.5.6.2 The full complement of BIU's shall be supplied with each cabinet to allow for maximum phase and function utilization for which the cabinet is designed.

2.7.5.6.3 2.7.5.6.3 Each BIU shall include power on, transmit and valid data indicators. All indicators shall be LEDs.

2.7.5.7 Cabinet Power Supply

2.7.5.7.1 2.7.5.7.1 The cabinet power supply shall meet the requirements of the NEMA TS 2-1998 Standard.

2.7.5.7.2 2.7.5.7.2 One cabinet power supply shall be supplied with each cabinet assembly.

2.7.6 TESTING

2.7.6.1 Testing

2.7.6.1.1 Each controller and cabinet assembly shall be tested as a complete entity under signal load for a minimum of 48 hours.

2.7.6.1.2 Each assembly shall be delivered with a signed document detailing the cabinet final tests performed.

2.7.6.1.3 The cabinet shall be assembled and tested by the controller manufacturer or authorized local distributor to ensure proper component integration and operation.

2.8 BENCH AND TRAINING EQUIPMENT

2.8.1. The successful Bidder will furnish, install, interconnect, configure and integrate all equipment and accessories necessary to establish a bench testing and training area at MCDOT. Services shall be conducted between the hours of 7:00 AM and 4:00 PM, Monday to Friday. No services shall be conducted during MCDOT's observed holidays.

At a minimum the bench test equipment shall include the following equipment, as specified elsewhere in this document, and all the cables and accessories necessary to interconnect the equipment in a manner that simulates the intended field connection configurations:

2.8.1.1 3 fiber optic transceivers;
2.8.1.2 3 twisted-wire pair modems;
2.8.1.3 2 telephone modems;
2.8.1.4 Spread spectrum radio equipment needed to fully support 3 transmitting and receiving sites;
2.8.1.5 2 TS-2 controllers; and
2.8.1.6 2 fully equipped controller field cabinets mounted on a portable base with lockable wheels/rollers.

In addition to the above equipment, shall furnish and install the following:

2.8.2. SOFTWARE

The vendor shall supply software for the purpose of validating communication with the controller. The software shall operate on a Windows NT PC and utilize the computer's RS232 port for communication. The software will allow communication testing to be performed utilizing the various communication equipment and media required for the full system implementation. Additionally, the software will be utilized to verify compliance with NTCIP standards identified in this specification. It shall be possible to formulate and transmit any request or command supported by the controller using the software.

2.8.3. NOTEBOOK COMPUTER

Provide a ruggedized notebook computer that will support the software specified in 2.8.2 with all of the interfaces required to perform the required tests and meet the following minimum requirements:

2.8.3.1 Durability Features

2.8.3.1.1 Designed using MIL-STD-810E test procedures;
2.8.3.1.2 Alloy case with carry handle;
2.8.3.1.3 Moisture and dust resistant LCD, keyboard, and touch pad;
2.8.3.1.4 Sealed port and connector covers; and
2.8.3.1.5 Removable hard drive mounted in a shock absorbing case.

2.8.3.2 CPU/Storage/Software

2.8.3.2.1 500MHz Intel Pentium III Processor;
2.8.3.2.2 64 MB of RAM;
2.8.3.2.3 10 GB Hard Drive;
2.8.3.2.4 CD-ROM Drive; and
2.8.3.2.5 Microsoft Windows NT, Microsoft Office, and software specified in 2.8.2 installed.

2.8.3.3 Display/Inputs

2.8.3.3.1 12.1-inch LCD;
2.8.3.3.2 87-key Keyboard; and
2.8.3.3.3 Touch Pad.

2.8.3.4 Interfaces

2.8.3.4.1 Serial port with DB-9 connector;
2.8.3.4.2 Parallel port with DB-25 connector;
2.8.3.4.3 External Keyboard/mouse port;
2.8.3.4.4 USB port; and
2.8.3.4.5 Modem port, 56Kbps, with RJ-11 connector.

2.8.3.5 Power

2.8.3.5.1 Lithium Ion Battery.

2.8.3.6 External/Spare Equipment

2.8.3.6.1 External 1.44MB Floppy Disk Drive and interface cable;
2.8.3.6.2 External mouse;
2.8.3.6.3 External AC adapter power supply;
2.8.3.6.4 Spare Lithium Ion Battery;
2.8.3.6.5 Battery Charger; and
2.8.3.6.6 Durable storage case with shoulder strap large enough to house the notebook computer and all external equipment/cables.

2.8.4. TRAFFIC SIGNAL SIMULATION TEST BOX

Provide a test box that is used to test/verify the TS-2 controllers operation and programming without being connected to the actual signalized intersection. The test box shall simulate full intersection operations (i.e., signal transition to green yellow and red, vehicle and pedestrian calls, emergency preemption, etc.).

Provide all hardware, software, cables and accessories necessary to connect to the TS-2 controller and power source to fully simulate the operation of a signalized intersection from the work bench.

2.8.5. WORK BENCH

Furnish, install, interconnect, configure and integrate all equipment and accessories necessary to establish a work bench in the MCDOT signal shop. The work bench shall be no less than 30 inches deep and 12 feet in total length. The working surface of the bench shall be 36-40 inches in height. No flammable material shall be used in the bench. The working surfaces of the bench shall be non-conductive. The bench shall include an overhead shelf at least 22 inches deep. The shelf shall contain 1.5 inch diameter holes at the rear of the shelf every 36 inches or at least 1.5 inches of space between the rear of the shelf and the wall or any back panels. The overhead shelf shall be at least 24 inches above the working surface of the bench. GFI outlets shall be provided every 36 inches at the rear of the bench facing outward above the working surface.

The front of the working surface of the bench shall be directly supported. The bench shall be suitable for heavy-duty use and shall support up to 200 pounds at any given location on the surface without sustaining permanent deformation.

2.9 TRAINING

2.9.1 Both off-site and on-site training shall be provided. Services shall be conducted between the hours of 8:00 AM and 5:00 PM, Monday to Friday. No services shall be conducted during MCDOT's observed holidays.

2.9.2 Training shall consist of one week of training MCDOT personnel on the operation and installation of the equipment supplied. Up to 8 people will attend each training session. At a minimum these training sessions shall include:

2.9.2.1 Use of controller interface;
2.9.2.2 Controller database use and manipulation;
2.9.2.3 Controller parameter and database entry;
2.9.2.4 Error messages and troubleshooting techniques;
2.9.2.5 Log report generation;
2.9.2.6 Overview of cabinet structure and interfacing;
2.9.2.7 Cabinet assembly and setup; and
2.9.2.8 Telecommunications equipment interfacing.

2.9.3 The training session shall consist of both formal classroom presentation (off-site training) and "hands-on" workshops (on-site training). All of the classroom training shall be provided at the Supplier's offices or operations center.

2.9.4 On-site training sessions shall consist of at least 4 separate 4-hour sessions. The "hands-on" workshops shall be conducted using the bench test setup at the MCDOT signal shop, 2909 W. Durango Street. The MCDOT bench test setup shall be furnished, installed, interconnected, configured and integrated by the Supplier prior to the training sessions.

2.9.5 All training material shall be delivered to MCDOT for approval sixty days before the start of the training session.

2.10 SPREAD SPECTRUM ANALYSIS AT CANDIDATE INTERSECTIONS

Upon MCDOT's request, the Supplier shall provide services in the field to verify the viability of providing spread spectrum radio at MCDOT intersections. A list of candidate intersections at which the tests shall be conducted will be prepared by MCDOT. A separate fee shall be submitted for the provision of these services as outlined in the price sheet. For the purposes of estimating this fee, there are estimated to be approximately 50 intersections at which these tests will be conducted. Services shall be conducted between the hours of 8:00 AM and 5:00 PM, Monday to Friday. No services shall be conducted during MCDOT's observed holidays.

The field tests shall consist of the following:

2.10.1 Line-of-sight

The Supplier shall determine the feasibility of providing spread spectrum communications at the candidate intersections using line-of-sight analysis in the field. The equipment shall be mounted at its approximate permanent installation location at each intersection during the testing.

2.10.2 Radio Frequency analysis

The Supplier shall conduct a radio frequency (spectrum) analysis at MCDOT's request at each of the candidate intersections. The Supplier shall verify that a signal can be transmitted and received successfully in the specified spectrum at each candidate intersection. The Supplier shall provide MCDOT with a table showing each intersection, the results of the tests, and a recommendation on whether or not spread spectrum radio should be used at each location.

2.11 BID COMPLIANCE

2.11.1 Equipment and materials bid shall be new, current design and meet specifications. Proposers must identify the manufacturer of each product that they are bidding. Proposers should supply all information necessary for the County to determine (a) whether the product offered meets the requirements of the specifications, and (b) exactly what the Proposers propose to furnish. The Proposers must certify that the material offered meets all technical specifications of the bid documents. Proposers may be requested to furnish samples of items proposed for examination by the County. Any item(s) so requested shall be furnished at no cost to the County. The County reserves the right to call for samples from any Proposers and submit the samples for evaluation. The County shall be the sole judge of whether the samples submitted meet the specifications.

2.11.2 Proposers shall have any and all licenses required to perform the work specified herein, and shall conform to all applicable Federal, state and local codes and laws.

2.11.3 Failure on the part of the Proposers to comply with all of the above instructions may result in bid rejection by the Board of Supervisors, and/or cancellation of orders without liability to the County.

2.12 WARRANTY

2.12.1 All equipment, units and components shall be guaranteed in accordance with the following clauses:

2.12.1.1 Guarantee that the equipment offered is free from defects in design and construction and that it will give continuous and efficient service under normal conditions for a period of 12 months from date of acceptance. The manufacturer's warranty shall be supplied in writing with each cabinet and controller. Second party extended warranties are not acceptable.

2.12.1.2 Guarantee that the equipment is the manufacturer's standard design in construction and that no changes or substitutions have been made.

2.12.1.3 Guarantee and agree to replace promptly without cost of any nature to the County during the period of 12 months from date of delivery any and all parts failing because of defects in design and/or construction excepting those parts that may fail as a result of accident, fire, or negligence on the part of the operating personnel. ("Promptly" in this case is defined to mean within 48 hours from time of demand.)

2.12.1.4 Any defects shall be corrected by the manufacturer or Supplier at no cost to the owner.

2.13 BENCH TEST/PRODUCT EVALUATION

Upon notification from MCDOT after preliminary screening of proposals, the acceptable Proposers will have 30 calendar days to demonstrate product specification compliance and interoperability

with all provided components at their preferred site within Maricopa County. The selection committee will travel to the site to evaluate the products. Bidders will be considered non-responsive or non-responsible if the following requirements are not met, within this 30 day period:

2.13.1 Provide submittal documentation/specifications for each item that is proposed, including controllers, cabinets, spread spectrum radio equipment, fiber optic transceivers, telephone modems and twisted wire pair modems (and all associated equipment and accessories necessary). The documents for each item shall contain all information necessary to determine product specification compliance. The Bidder shall clearly indicate, on the documentation, the exact model number, accessories, and options that are being proposed. If the standard manufacturer documentation does not specifically address all the product requirements that are required, then the Bidder shall obtain a letter from the manufacturer certifying compliance with each referenced requirement that is not indicated on the standard documentation. The Bidder shall submit 3 identical sets of this documentation to MCDOT for review and approval. Each set shall include a 3 ring binder with section tabs separating the documentation for each item being submitted. The section tabs shall be clearly labeled with the item number that the documentation within the section pertains to. If MCDOT requires modifications to the submitted documentation, the Bidder shall make the necessary modifications and resubmit the revised documentation. Allow for up to 2 weeks for MCDOT to review the submitted documentation for each submittal. The Bidder shall be required to obtain final approval, in writing from MCDOT, on all items within the submitted documentation. The Bidder will not be allowed any time extensions regardless of any modifications necessary to submitted documentation.

2.13.2 Coordinate with MCDOT to establish the exact date, time and location of where the testing is to occur. No testing will be permitted outside the hours of 8:00 AM to 5:00 PM Monday to Friday or on MCDOT-recognized holidays. It is the responsibility of the Bidder to ensure that the time and location of testing is suitable for their testing purposes.

2.13.3 Provide MCDOT with documentation on how the test is to be performed; time to complete test, and how it will demonstrate compliance with all operational and functional requirements. MCDOT approval of the documentation is required before performing the test. If modifications to the testing documentation are required as a result of comments furnished by MCDOT, the Bidder shall make the necessary modifications and resubmit the revised documentation. Allow for up to 2 weeks for MCDOT to review the testing documentation for each submittal. Environmental requirements such as operating temperature and humidity ranges are not required to be tested if the Bidder can furnish documentation from the manufacturer certifying compliance with these requirements. The Bidder will not be allowed any time extensions regardless of any modifications necessary to testing documentation or required testing of environmental requirements.

At a minimum the test shall fully simulate the following field connection configurations while using the testing software on the notebook computer to simulate the future central software and the traffic signal simulation test box to simulate the operation of a typical signalized intersection:

2.13.3.1 Central communicating to each connected field controller on a single multi-dropped circuit via a leased telephone connection between central and the first controller location on the circuit and then via spread spectrum radio to each of the other 2 field controller locations. This spread spectrum radio equipment, at one of the controller locations, shall also function as a repeater site.

2.13.3.2 Central communicating to each connected field controller on a single multi-dropped circuit via a leased telephone connection between central and the first controller location on the circuit and then via single mode fiber optic cable to each of the other 2 field controller locations.

2.13.3.3 Central communicating to each connected field controller on a single multi-dropped circuit via a leased telephone connection between central and the first controller location on the circuit and then via twisted-wire pair cable to each of the other 2 field controller locations.

2.13.3.4 Central communicating to each connected field controller on a single multi-dropped circuit via a single mode fiber optic communication medium between central and the first field cabinet location and between each field cabinet location.

2.13.4 The Proposer shall demonstrate the interchangeability and interoperability of different components (for example, load switches, preemption devices, BIU's, or other available NEMA TS-2 standard equipment) during the test.

2.13.5 Conduct the test at the Proposer's offices or operations center in the presence of MCDOT and their representative(s) in accordance with the approved test documentation. Provide MCDOT with one week's notice prior to the scheduled testing date. No time extensions will be allowed regardless of any required testing or trouble shooting of problems. It is the responsibility of the Proposer to ensure that there are no technical glitches. MCDOT will allow only one test.

2.13.6 Upon notification from MCDOT, the apparent low Bidder will have 30 days to provide a written guarantee from each manufacturer, that this product model will be supported and available for purchase for a minimum of 5 years from the date that the guarantee is signed. If within the contract period technological advances to the proposed products are available and MCDOT agrees that the furnishing of a different product model is in the best interest of MCDOT, then the new product model can be provided within this contract provided that all of the requirements of the selection process are met for the new product. There shall be no additional cost to MCDOT for the replacement model or for its approval process.

2.14 TAX:

No tax shall be levied against labor. Bid pricing to include all labor, overhead, tools and equipment used, profit, and any taxes that may be levied. It is the responsibility of the bidder to determine any and all taxes and include the same in bid price.

3.0 SPECIAL TERMS & CONDITIONS:

3.1 CONTRACT LENGTH:

This Request for Proposals is for awarding a firm fixed price contract to cover a two (2) year period.

3.2 OPTION TO EXTEND:

The County may, at their option and with the approval of the Contractor, extend the period of this agreement up to a maximum of three (3), one (1) year options. The Contractor shall be notified in writing by the Materials Management Department of the County's intention to extend the contract period at least thirty (30) calendar days prior to the expiration of the original contract period.

3.3 INDEMNIFICATION AND INSURANCE

3.3.1 INDEMNIFICATION

To the fullest extent permitted by law, the **CONTRACTOR** shall defend, indemnify, and hold harmless the **COUNTY**, its agents, representatives, officers, directors, officials, and employees from and against all claims, damages, losses and expenses, including but not limited to attorney fees, court costs, expert witness fees, and the cost of appellate proceedings, relating to, arising out of, or alleged to have resulted from the acts, errors, omissions or mistakes relating to the performance of this Contract. **CONTRACTOR'S** duty to defend, indemnify and hold harmless the **COUNTY**, its agents, representatives, officers, directors, officials, and employees shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, or injury to, impairment, or destruction of property, including loss of use resulting therefrom, caused by any acts, errors, omissions or mistakes in the performance of this Contract including any person for whose acts, errors, omissions or mistakes, the **CONTRACTOR** may be legally liable.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

Abrogation of Arizona Revised Statutes Section 34-226:

In the event that A.R.S. § 34-226 shall be repealed or held unconstitutional or otherwise invalid by a court of competent jurisdiction, then to the fullest extent permitted by law, the **CONTRACTOR** shall defend, indemnify and hold harmless the **COUNTY**, its agents, representatives, officers, directors, officials and employees from and against all claims, damages, losses and expenses (including but not limited to attorney fees, court costs, and the cost of appellate proceedings), relating to, arising out of, or resulting from **CONTRACTOR'S** work or services. **CONTRACTOR'S** duty to defend, indemnify and hold harmless, the **COUNTY**, its agents, representatives, officers, directors, officials and employees shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, injury to, impairment or destruction of property including loss of use resulting therefrom, caused in whole or in part by any act or omission of the **CONTRACTOR**, anyone **CONTRACTOR** directly or indirectly employs or anyone for whose acts **CONTRACTOR** may be liable, regardless of whether it is caused in part by a party indemnified hereunder, including the **COUNTY.**

The amount and type of insurance coverage requirements set forth below will in no way be construed as limiting the scope of the indemnity in this paragraph.

The scope of this indemnification does not extend to the sole negligence of the **COUNTY**.

3.3.2 INSURANCE REQUIREMENTS:

CONTRACTOR, at **CONTRACTOR'S** own expense, shall purchase and maintain the herein stipulated minimum insurance with companies duly licensed, possessing a current A.M. Best, Inc. Rating of B++6, or approved unlicensed companies in the State of Arizona with policies and forms satisfactory to the **COUNTY**.

All insurance required herein shall be maintained in full force and effect until all work or service required to be performed under the terms of the Contract is satisfactorily completed and formally accepted. Failure to do so may, at the sole discretion of the **COUNTY**, constitute a material breach of this Contract.

The **CONTRACTOR'S** insurance shall be primary insurance as respects the **COUNTY**, and any insurance or self-insurance maintained by the **COUNTY** shall not contribute to it.

Any failure to comply with the claim reporting provisions of the insurance policies or any breach of an insurance policy warranty shall not affect coverage afforded under the insurance policies to protect the **COUNTY**.

The insurance policies may provide coverage which contains deductibles or self-insured retentions. Such deductible and/or self-insured retentions shall not be applicable with respect to the coverage provided to the **COUNTY** under such policies. The **CONTRACTOR** shall be solely responsible for the deductible and/or self-insured retention and the **COUNTY**, at its option, may require the **CONTRACTOR** to secure payment of such deductibles or self-insured retentions by a surety bond or an irrevocable and unconditional letter of credit.

The **COUNTY** reserves the right to request and to receive, within 10 working days, certified copies of any or all of the herein required insurance policies and/or endorsements. The **COUNTY** shall not be obligated, however, to review such policies and/or endorsements or to advise **CONTRACTOR** of any deficiencies in such policies and endorsements, and such receipt shall not relieve **CONTRACTOR** from, or be deemed a waiver of the **COUNTY'S** right to insist on strict fulfillment of **CONTRACTOR'S** obligations under this Contract.

The insurance policies required by this Contract, except Workers' Compensation, shall name the **COUNTY**, its agents, representatives, officers, directors, officials and employees as Additional Insureds.

The policies required hereunder, except Workers' Compensation, shall contain a waiver of transfer of rights of recovery (subrogation) against the **COUNTY**, its agents, representatives, officers, directors, officials and employees for any claims arising out of **CONTRACTOR'S** work or service.

3.3.3 Commercial General Liability. **CONTRACTOR** shall maintain Commercial General Liability insurance with a limit of not less than $1,000,000 for each occurrence with a $2,000,000 Products/Completed Operations Aggregate and a $2,000,000 General Aggregate Limit. The policy shall include coverage for bodily injury, broad form property damage, personal injury, products and completed operations and blanket contractual coverage including, but not limited to, the liability assumed under the indemnification provisions of this Contract which coverage will be at least as broad as Insurance Service Office, Inc. Policy Form CG 00 01 10 93 or any replacements thereof. The coverage shall include X, C, U.

The policy shall contain a severability of interest provision, and shall not contain a sunset provision or commutation clause, or any provision which would serve to limit third party action over claims.

The Commercial General Liability additional insured endorsement shall be at least as broad as the Insurance Service Office, Inc.'s Additional Insured, CG 20 10 11 85, and shall include coverage for **CONTRACTOR'S** operations and products and completed operations.

If the **CONTRACTOR** subcontracts any part of the work, services or operations awarded to the **CONTRACTOR**, he shall purchase and maintain, at all times during prosecution of the work, services or operations under this Contract, an Owner's and **CONTRACTOR'S** Protective Liability insurance policy for bodily injury and property damage, including death, which may arise in the prosecution of the **CONTRACTOR'S** work, service or operations under this Contract. Coverage shall be on an occurrence basis with a limit not

less than $1,000,000 per occurrence, and the policy shall be issued by the same insurance company that issues the **CONTRACTOR'S** Commercial General Liability insurance.

3.3.4 Automobile Liability. **CONTRACTOR** shall maintain Automobile Liability insurance with an individual single limit for bodily injury and property damage of no less than $1,000,000, each occurrence, with respect to **CONTRACTOR'S** vehicles (whether owned, hired, non-owned), assigned to or used in the performance of this Contract.

3.3.5 Workers' Compensation. The **CONTRACTOR** shall carry Workers' Compensation insurance to cover obligations imposed by federal and state statutes having jurisdiction of **CONTRACTOR'S** employees engaged in the performance of the work or services, as well as Employer's Liability insurance of not less than $1,000,000 for each accident, $1,000,000 disease for each employee, and $1,000,000 disease policy limit.

In case any work is subcontracted, the **CONTRACTOR** will require the Subcontractor to provide Workers' Compensation and Employer's Liability insurance to at least the same extent as required of the **CONTRACTOR**.

3.4 CERTIFICATES OF INSURANCE

Prior to commencing work or services under this Contract, **CONTRACTOR** shall furnish the **COUNTY** with Certificates of Insurance, or formal endorsements as required by the Contract, issued by **CONTRACTOR'S** insurer(s), as evidence that policies providing the required coverages, conditions and limits required by this Contract are in full force and effect. Such certificates shall identify this contract number and title.

In the event any insurance policy(ies) required by this contract is(are) written on a "claims made" basis, coverage shall extend for two years past completion and acceptance of the **CONTRACTOR'S** work or services and as evidenced by annual Certificates of Insurance.

If a policy does expire during the life of the Contract, a renewal certificate must be sent to the **COUNTY** fifteen (15) days prior to the expiration date.

3.5 CANCELLATION AND EXPIRATION NOTICE

Insurance required herein shall not expire, be canceled, or materially changed without thirty (30) days prior written notice to the **COUNTY.**

3.6 REQUIREMENT OF CONTRACT BONDS:

Concurrently with the submittal of the Contract, the Contractor shall furnish the Contracting Agency the following bonds, which shall become binding upon the award of the Contract to the Contractor.

3.6.1 A Performance Bond in an amount equal to the full Contract amount (or as specified) conditioned upon the faithful performance of the Contract in accordance with plans, specifications and conditions thereof. Such bond shall be solely for the protection of the Contracting Agency awarding the Contract.

Each such bond shall include a provision allowing the prevailing party in a suit on such bond to recover as a part of his judgment such reasonable attorney's fees as may be fixed by a judge of the court.

Each such bond shall be executed by a surety company or companies holding a certificate of authority to transact surety business in the State of Arizona issued by the Director of the Department of Insurance. The bonds shall not be executed by an individual surety or sureties. The bonds shall be made payable and acceptable to the Contracting Agency. The bonds shall be written or countersigned by an authorized representative of the surety who is either a resident of the Sate of Arizona or whose principal office is maintained in this state, as by law required, and the bonds shall have attached thereto a certified copy of the Power of Attorney of the signing official. In addition, said company or companies shall be rated "Best-A" or better as required by the Contracting Agency, as currently listed in the most recent Best Key Rating Guide, published by the A.M. Best Company.

3.7 PERFORMANCE BOND:

The successful Contractor will be required to furnish a performance bond in the amount of (20% of total price) within 10 days from receipt of notification of award. Date of U.S. postmark will be accepted as date of delivery of performance bond. Contractors are requested to tender this bond on a Document approved by the Arizona Department of Insurance. One Contractor failing to supply a performance bond as required will forfeit his right to the contract. An irrevocable letter of credit or certificate of deposit will be accepted in lieu of bond. **Performance bonds are to be identified with PROPOSAL serial number, title and return address.**

3.8 TESTING:

Unless otherwise specified, materials and equipment purchased will be inspected by the receiving activity as to meeting the quality and quantity requirements of the solicitation. When deemed necessary, samples of supplies or materials will be taken at random form stock received for submission to a commercial laboratory or other appropriate agency, for analysis and test as to whether the material conforms in all respects to the specifications. In cases where commercial laboratory reports indicate that the materials do not meet the specifications, the expense of such analysis is to be borne by the Proposer holding the contract.

3.9 TERMS AND PAYMENT:

Payment under contract will be made in the manner provided by law. Invoices shall be prepared and submitted in accordance with the instructions provided on the Purchase Order. Invoices shall contain the following information: Purchase Order number, item numbers, description of supplies and or/services, sizes, quantities, unit prices and extended totals and applicable sales/use tax. The County is not subject to excise tax.

3.10 ACCEPTANCE:

Upon successful completion of the performance period, the system shall be deemed accepted and the warranty period begins. All documentation shall be completed prior to final acceptance.

3.11 FACILITIES:

During the course of this Contract, the County shall provide the Contractor's personnel with adequate workspace for CONTRACTORS and such other related facilities as may be required by Contractor to carry out its obligation enumerated herein.

3.12 TECHNICAL AND DESCRIPTIVE LITERATURE:

Proposer(s) must include complete manufacturer's technical and descriptive literature regarding the material they propose to provide. Literature shall be sufficient in detail in order to allow full and fair evaluation of the offer submitted. Failure to include this information may result in the PROPOSAL being rejected.

3.13 PROCUREMENT CARD ORDERING CAPABILITY:

It is the intent of Maricopa County to utilize the Bank of America MC Procurement Card or other procurement card that may be used by the County from time to time, to place and make payment for orders under this Contract. PROPOSERS without this capability may be considered non-responsive and not eligible for award consideration.

Purchase Card Clarification.
Maricopa County's Bank of America Purchase Card program is based on the MasterCard charge card. There is no charge from Maricopa County for the program, any costs or charges to the vendor or contractor will be based on the transaction dollar amount and is from the Vendors/contractors servicing Bank. The vendor/contractor should contact their bank to arrange for the acceptance and information concerning any charges to use this program.
The advantages of accepting the purchase card for payment are as follows.

3.13.1 The bank pays the vendor/contractor in 48 to 72 hours versus 30 days from Maricopa County.

3.13.2 The vendor/contractor does not have to invoice Maricopa County.

3.13.3 The vendor/contractor does not have to carry that transaction in their account receivable.

Maricopa County offers this opportunity only to vendors/contractors that are not 1099 reportable to the Internal Revenue Service. Maricopa County will be asking those vendors/contractors that are offered this opportunity to give the County a prompt payment discount.

3.14 PROMPT PAYMENT DISCOUNT:

Maricopa County, through its "Purchase Card Process" has initiated changes that are intended to both improve and expedite the purchasing and payment process. In light of these efforts, PROPOSERS are strongly encouraged to offer Maricopa County prompt payment discounts for this service and take into consideration receipt of payment with seventy-two (72) hours from time of payment processing. Discounts offered will be considered in the evaluation price analysis process.

3.15 INTERNET ORDERING CAPABILITY:

It is the intent of Maricopa County to utilize the Internet to place orders under this price contract. Proposers without this capability may be considered non-responsive and not eligible for award consideration.

4.0 CONTRACT TERMS & CONDITIONS:

4.1 LANGUAGE FOR REQUIREMENTS CONTRACTS:

Contractors signify their understanding and agreement by signing this document, that the Contract resulting from this proposal will be a requirements contract. However, this Contract does not guarantee that any purchases will be made. It only indicates that if purchases are made for the services contained in this Contract, that they will be purchased from the Contractor awarded that item. Orders will only be placed when a need is identified by a Using Agency or Department and proper authorization and documentation have been approved.

4.2 ESCALATION:

Any requests for price adjustments must be submitted thirty (30) days prior to the Contract renewal date. Justification for the requested adjustment in cost of labor and/or materials must be accompanied by appropriate documentation. Escalation shall not exceed the increase in the U.S. Department of Labor (Bureau of Labor Statistics) Consumer Price Index for Urban Consumers.

Increases shall be approved in writing by the Materials Management Department prior to any adjusted invoicing submitted for payment.

4.3 UNCONDITIONAL TERMINATION FOR CONVENIENCE:

Maricopa County may terminate the resultant Contract for convenience by providing sixty (60) calendar days advance notice to the Contractor.

4.4 DEFAULT:

The County may suspend, terminate, or modify this contract immediately upon written notice to the Contractor in the event of a nonperformance of stated objectives or other material breach of contractual obligations; or upon the happening of any event which would jeopardize the ability of the Contractor to perform any of its contractual obligations. Maricopa County reserves the right to have service provided by other than the Contractor if the Contractor is unable or fails to provide requested service within the specified time frame.

4.5 TERMINATION BY THE COUNTY:

If the Contractor should be adjudged bankrupt or should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, the County may terminate this Agreement. If the Contract should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to provide enough properly skilled workers or proper materials, or persistently disregard laws and ordinances, or not proceed with work or otherwise be guilty of, a substantial violation of any provision of this Agreement, then the County may terminate this Agreement. Prior to termination of this Agreement, the County shall give the Contractor fifteen (15) calendar days written notice. Upon receipt of such termination notice, the Contractor shall be allowed fifteen (15) calendar days to cure such deficiencies.

4.6 APPROPRIATION CONTINGENCY:

The Contractor recognized that any agreement entered into shall commence upon the day first provided and continued in full force and effect until termination in accordance with its provisions. The Contractor and the County herein recognized that the continuation of any contract after the close of any given fiscal year of the County which fiscal years end on June 30 of each year, shall be subject to the approval of the budget of the County providing for or covering such contract item as an expenditure therein. The County does not represent that said budget item will be actually adopted, said determination being the determination of the County Board of Supervisors at the time of the adoption of the budget.

4.7 ORGANIZATION - EMPLOYMENT DISCLAIMER:

The Contract is not intended to constitute, create, give rise to or otherwise recognize a joint venture agreement or relationship, partnership or formal business organization of any kind, and the rights and obligations of the parties shall be only those expressly set forth in the Contract.

The parties agree that no persons supplied by the Contractor(s) in the performance of obligations under the agreement are considered to be County employees, and that no rights of County civil service, retirement or personnel rules accrue to such persons. The Contractor(s) shall have total responsibility for all salaries, wages, bonuses, retirement withholdings, workmen's compensation, other employee benefits and all taxes and premiums appurtenant thereto concerning such persons, and shall save and hold the County harmless with respect thereto.

4.8 STATUTORY RIGHT OF CANCELLATION FOR CONFLICT OF INTEREST:

Notice is given that pursuant to A.R.S. § 38-511 the County may cancel this Contract without penalty or further obligation within three years after execution of the contract, if any person significantly involved in initiating, negotiating, securing, drafting or creating the contract on behalf of the County is at any time while the Contract or any extension of the Contract is in effect, an employee or agent of any other party to the Contract in any capacity or CONTRACTOR to any other party of the Contract with respect to the subject matter of the Contract. Additionally, pursuant to A.R.S. § 38-511 the County may recoup any fee or commission paid or due to any person significantly involved in initiating, negotiating, securing, drafting or creating the contract on behalf of the County from any other party to the contract arising as the result of the contract.

4.9 OFFSET FOR DAMAGES:

In addition to all other remedies at Law or Equity, the County may offset from any money due to the Contractor any amounts Contractor owes to the County for damages resulting from breach or deficiencies in performance under this Contract.

4.10 ADDITIONS/DELETIONS OF SERVICE:

The County reserves the right to add and/or delete services to this Contract. Should a service requirement be deleted, payment to the Contractor will be reduced proportionally, to the amount of service reduced in accordance with the PROPOSED price. Should additional services be required from this Contract, prices for such additions will be negotiated between the Contractor and the County.

4.11 ASSIGNMENT OR SUBCONTRACTING:

Neither this Agreement, nor any portion thereof, may be assigned by Contractor without the written consent of the County first having been obtained. Any attempt by the Contractor to assign or subcontract any performance of this Contract without the written consent of the County shall be null and void and shall constitute a breach of this Contract.

The Subcontractor's rate for the job shall not exceed that of the Prime Contractor's rate, as PROPOSED in the pricing section, unless the Prime Contractor is willing to absorb any higher rates. The Subcontractor's invoice shall be invoiced directly to the Prime Contractor, who in turn shall pass-through the costs to the County, without mark-up. A copy of the Subcontractor's invoice must accompany the Prime Contractor's invoice.

4.12 AMENDMENTS:

All amendments to this Contract must be in writing and signed by both parties.

4.13 CONFORMATION WITH THE LAW:

This service shall be accomplished in conformity with the laws, ordinances, rules, regulations and zoning restrictions of the United States of America, the State of Arizona, County of Maricopa, and the City of Phoenix.

4.14 CONTRACT COMPLIANCE MONITORING:

The Materials Management Department and Using agency(s) shall monitor the Contractors compliance with, and performance under, the terms and conditions of the Contract. The Contractor shall make available for inspection and/or copying by the County all records and accounts relating to the work performed or the services provided in this Contract.

4.15 RETENTION OF RECORDS:

The Contractor agrees to retain all financial books, records, and other documents relevant to this Contract for five (5) years after final payment or until after the resolution of any audit questions which could be more than five (5) years, whichever is longer. The Department, Federal or State auditors and any other persons duly authorized by the Department shall have full access to, and the right to examine, copy and make use of any and all said materials.

4.16 ADEQUACY OF RECORDS:

If the Contractor's books, records and other documents relevant to this Contract are not sufficient to support and document that allowable services were provided to eligible clients the Contractor shall reimburse Maricopa County for the services not so adequately supported and documented.

4.17 AUDIT DISALLOWANCES:

If at any time it is determined by the Department that a cost for which payment has been made is a disallowed cost, the Department shall notify the Contractor in writing of the disallowance and the required course of action ,which shall be at the option of the Department either to adjust any future claim submitted by the Contractor by the amount of the disallowance or to require repayment of the disallowed amount by the Contractor forthwith issuing a check payable to Maricopa County.

4.18 P.O. CANCELLATION LANGUAGE:

The Department of Materials Management reserves the right to cancel Purchase Orders within a reasonable period of time after issuance. Should a Purchase Order be canceled, the County agrees to reimburse the Contractor but only for actual and documentable costs incurred by the Contractor due to and after issuance of the Purchase Order. The County will not reimburse the Contractor for any costs incurred after receipt of County notice of cancellation, or for lost profits, shipment of product prior to issuance of Purchase Order, etc. Contractors agree to accept verbal notification of cancellation from the Department of Materials Management with written notification to follow. By submitting a proposal in response to this solicitation, the Contractor specifically acknowledges to be bound by this cancellation policy.

4.19 RIGHTS IN DATA:

The County shall have the use of data and reports resulting from this Contract without additional cost or other restriction except as may be established by law or applicable regulation. Each party shall supply to the other party, upon request, any available information that is relevant to this Contract and to the performance hereunder.

4.20 SECURITY AND PRIVACY:

The Contractor agrees that none of its officers or employees shall use or reveal any research or statistical information furnished by any person and identifiable to any specific private person for any purpose other than the purpose for which it was obtained. Copies of such information shall not, without the consent of the person furnishing such information, be admitted as evidence or used for any purpose in any action, suit, or other judicial or administrative proceedings, unless ordered by a court of competent jurisdiction. The County shall be notified immediately upon receipt of any such order of court, pertaining to production of such information.

The Contractor shall incorporate the foregoing provisions of this paragraph in all of its authorized Subcontracts.

4.21 SEVERABILITY:

Any provision of this Contract which is determined to be invalid, void, or illegal shall in no way affect, impair, or invalidate any other provision hereof, and remaining provisions shall remain in full force and effect.

4.22 VALIDITY:

The invalidity, in whole or in part, of any provision of this Agreement shall not void or affect the validity of any other provision of this Contract.

4.23 CONTRACTOR RESPONSIBILITY:

The Contractor will be responsible for any damages whatsoever to County property as applicable when such property is the responsibility or in the custody of the Contractor, his Employees or Subcontractors.

Contractor agrees that all Subcontractors performing work under this Contract shall comply with its provisions and it is expressly understood that all persons employed by the Contractor, either directly or indirectly, shall be considered employees of the Contractor, and not employees of Maricopa County.

Contractor acknowledges and agrees that it is liable and responsible for any act or omission by the Contractor, its employees, agents, officers, representatives, and subcontractors occurring in the course of Contractor's performance of this Contract, whether such act or omission occurs on County property or elsewhere. Contractor shall be liable for any loss or damage arising out of or related to Contractor's performance of this contract, Contractor shall bear the above stated liability, even in absence of its own negligence, unless County actions caused the loss or damage (i.e., if regulation, but damage occurs, Contractor is responsible for such damages.) Contractor shall bear the above stated liability, consequential, incidental, direct, and indirect damages, and shall be liable for all costs, including attorney's fees, incurred by the County to enforce this provision.

4.24 FAILURE TO PROVIDE SERVICES:

Maricopa County reserves the right to have service provided by other than the Contractor if the Contractor is unable or fails to provide requested service within the specified time frame.

4.25 DELIVERY:

It shall be the Contractor's responsibility to meet the County's delivery requirements, as called for in the Technical Specifications. Maricopa County reserves the right to obtain material on the open market in the event the Contractor fails to make delivery and any price differential will be charged against the Contractor.

4.26 PRICE REDUCTIONS:

By submitting a proposal in response to this solicitation, Contractors agree to guarantee that Maricopa County is receiving the lowest price offered by your company to other customers for similar services at comparable volumes in a similar geographic area**.** If at any time during the contract period your company offers a lower price to another customer, SIMILAR PRICES MUST BE EXTENDED TO MARICOPA COUNTY If a notification IS not made of said price reductions, upon discovery Maricopa County shall reserve the right to take any or all of the following actions:

4.26.1 Cancel the Contract, if it is currently in effect.

4.26.2 Determine the amount which the County was overcharged and submit a request for payment from the Contractor for that amount.

4.26.3 Take the necessary steps to collect any performance surety provided on the applicable contract.

4.27 CHANGES:

The County may require changes in the scope of the services to be performed by the Contractor hereunder. All such changes, which are mutually agreed upon by and between all the parties, shall be incorporated in written amendments to this Contract. All such amendments shall state any increase or decrease in the amount of the compensation due to the Contractor for the change in scope.

4.28 EMPLOYEE RESPONSIBILITY:

No responsibility will attach to a county employee for the premature opening of a proposal not properly addressed and identified in accordance with the proposal documents.

ECONOLITE CONTROL PRODUCTS INC, 3360 E LA PALMA AVENUE, ANAHEIM, CA 92806

WILLING TO ACCEPT FUTURE SOLICITATIONS VIA EMAIL: __X___ YES _____ NO

ACCEPT PROCUREMENT CARD: __X___ YES _____ NO

REBATE (CASH OR CREDIT) FOR UTILIZING PROCUREMENT CARD: _____ YES __X__ NO _____ % REBATE
(Payment shall be made within 48 hrs utilizing the Purchasing Card)

INTERNET ORDERING CAPABILITY: __X__ YES _____ NO _____ % DISCOUNTS

OTHER GOV'T. AGENCIES MAY USE THIS CONTRACT: ___X__YES _____ NO

PRICING SHEET C631001, /B0604245 ~~C631002/B0604204~~

PRICING:
NOTE: DO NOT INCLUDE SALES/USE TAX IN YOUR BID PRICE. The percentage of sales/use tax applicable to this contract will be listed on the purchase order and allowed at time of payment. BIDDERS CERTIFY BY SIGNING THIS AGREEMENT THAT PRICES BID ARE F.O.B. DESTINATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS SET FORTH HEREIN.

DO NOT INCLUDE SALES/USE TAX IN YOUR BID PRICE. The percentage of sales/use tax applicable to this contract will be listed on the purchase order and allowed at time of payment.

Quantities as shown in the bid form are estimates only based upon available information. The County reserves the right to adjust the quantities as necessary to meet its needs.

The Proposers hereby certify that they have read, understand, and agree that acceptance by Maricopa County of the forth in the Maricopa County Procurement Code, and amendments thereto, together with the specifications and other documentary forms herewith made a part of this specific procurement. Proposer's offer by the issuanc of a purchase order or contract will create a binding contract. Further, they agree to fully comply with all terms and conditions as set

Equipment (held for 5 years)	**Price per Order Quantity**			
	1	5	10	20
Fiber Optic Transceiver (Standalone)	$ 1,413.00	$ 1,413.00	$ 1,413.00	$ 1,319.00
Fiber Optic Transceiver (Card)	$ 1,187.00	$ 1,187.00	$ 1,187.00	$ 1,108.00
Optical Transceiver Card Cage	$ 1,493.00	$ 1,493.00	$ 1,493.00	$ 1,393.00
Twisted-Wire Pair Modem	$ 886.00	$ 886.00	$ 886.00	$ 827.00
Telephone Modem	$ 886.00	$ 886.00	$ 886.00	$ 827.00
EIA-232 Line Sharing Unit	$ 297.00	$ 297.00	$ 297.00	$ 277.00
Spread Spectrum Radio Equipment****	$ 4,159.00	$ 4,159.00	$ 4,159.00	$ 3,881.00
TS 2 Type 2 Controller	$ 1,875.00	$ 1,875.00	$ 1,875.00	$ 1,800.00
TS 2 Type 1 Cabinet (including auxiliary equipment)	$ 9,985.00	$ 9,985.00	$ 9,557.00	$ 9,557.00
Cabinet Extension	$ 208.00	$ 208.00	$ 208.00	$ 208.00
Notebook Computer	$ 3,214.00	$ 3,000.00	$ 3,000.00	$ 3,000.00
Traffic Signal Simulation Test Box	$ 4,633.00	$ 4,324.00	$ 4,324.00	$ 4,324.00
Work Bench	$10,203.00	$10,203.00	$10,203.00	$10,203.00
Load Switch	$ 25.00	$ 25.00	$ 25.00	$ 25.00
Flasher	$ 26.00	$ 26.00	$ 26.00	$ 26.00
Flash Transfer Relay	$ 20.00	$ 20.00	$ 20.00	$ 20.00
Loop Detector Unit	$ 151.00	$ 151.00	$ 151.00	$ 116.00
MMU	$ 739.00	$ 739.00	$ 739.00	$ 640.00
BIU	$ 279.00	$ 279.00	$ 279.00	$ 217.00

Cabinet Power Supply	$ 413.00	$ 413.00	$ 413.00	$ 371.00

ECONOLITE CONTROL PRODUCTS INC, 3360 E LA PALMA AVENUE, ANAHEIM, CA 92806

Other Items:				
Power Splitter **(ZAPD-1)**	$ 185.00	$ 185.00	$ 171.00	$ 171.00
900 MHz Yagi Antenna (Directional) **ANT-900D/16**	$ 223.00	$ 223.00	$ 207.00	$ 207.00
900 MHz Yagi Antenna (Omni-Directional**) ANT-900M/7**	$ 171.00	$ 185.00	$ 185.00	$ 171.00
2.4 GHz Yagi Antenna (Directional) **ANT-2.4D/16**	$ 215.00	$ 215.00	$ 200.00	$ 200.00
2.4 GHz Yagi Antenna (Omni-Directional) **ANT-2.4M/9**	$ 200.00	$ 200.00	$ 186.00	$ 186.00
900 MHz Spread Spectrum Radio **SS900DS-6**	$ 2,885.00	$ 2,885.00	$ 2,680.00	$ 2,680.00
2.4 GHz Spread Spectrum Radio **SS2400DS-6**	$ 3,448.00	$ 3,448.00	$ 3,200.00	$ 3,200.00
900 MHz Lighting Protector **SSLP-DCB2**	$ 155.00	$ 155.00	$ 143.00	$ 143.00
2.4GHz Lightning Protector **SSLP-GT09N01**	$ 155.00	$ 155.00	$ 143.00	$ 143.00
LMR 400 Low Loss Cable **CBL-LMR400UF**	$ 1.75	$ 1.75	$ 1.65	$ 1.65
TS2 Type ½Phrase 55" "P" Cabinet per specifications	$ 8,245.00	$ 8,245.00	$ 7,893.00	$ 7,893.00
TS2 Type ½Phrase 49" "M" Cabinet per specifications	$ 8,155.00	$ 8,155.00	$ 7,807.00	$ 7,807.00

Spread spectrum analysis at candidate intersections	**$1,500**/week flat travel fee + $125/hr minimum 8 hours Includes complete path analysis testing and documentation.
Training	**$15,000** – Includes 64 hours of training for 8 people at Econolite's facility in Anaheim, CA. Price includes air travel, hotel, and lunch each day of training. The County may chose to split the training time at Econolite and Maricopa Counties facility.
Maintenance and Repairs	All items under warranty will be repaired at no charge to the County. The county is responsible for freight or shipping charges incurred sending the items to Econolite. When items are out of warranty, the County may send the items back for a repair estimate.
****Price for the Spread Spectrum Radio includes:	Radio, Power Supply, Antenna, Lightning Protector, 200' Cable+Conn.

Terms:	NET 30
Federal Tax ID Number	95-3196532
Vendor Number:	953196532
Telephone Number:	714/630-3700 (X232)
Fax Number:	714/630-5120
Company Web site:	www.econolite.com
E-Mail Address (REP)	cloyd@econolite.com
Contact Person	Craig Loyd
Contract Period:	To cover the period ending **November 30, 2003.**